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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

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Contents of This Issue

Editorials 53

Frontispiece—Electric Heat Advances Rapidly 56

Cincinnati's Single-Control Traffic Signal System 57

BY W. L. MCMAHAN.

A description of Cincinnati's new traffic signal system, said to be the largest in the United States, if not in the world, which was formally turned over to the city in the spring.

Rural Service Rapidly Increasing in Alabama 59

A review of the rural electrification work that is being done by the Alabama Power Company in conjunction with the Alabama Polytechnic Institute.

Savings from Power Factor Correction...61

The method used by the Columbia Electric Railway Company in gathering and tabulating data which showed the absolute necessity for the installation of the necessary corrective apparatus.

Essentials of Modern Street Lighting....65

BY C. J. STAHL.

An interesting article telling how the desired effects can be produced and emphasizing the need for safety, ornamentation and advertising value.

Brush Friction Greatly Affected by Contact Air Pressure.....67

BY W. E. STINE.

Record of Cable Laying in Japan.....69

BY K. TAKAHASHI.

Letters from Our Readers.....70

Central Station and Industrial Practice...71

Pole Preservation Permits More Economical Utilization of Timber 71
Protection of Small Buses.....71
Simplification of Line Calculations.....72
High-Tension Buses Suspended on Individual Steel Structures 73
Costs of Line Construction Work at Gardner, Mass. 74

Commercial Activities and Public Relations 75

Appliance Demonstrator Complete in Details....75
Effect of Electric Appliances on Physical Labor..75
Guaranteeing Satisfaction Aids Heating Sales....75
A Complete and Simple Prospect Record.....76
Possibilities of Silo Filling with an Electric Motor 76

Digest of Electrical Literature.....78

New Books.....80

News of the Industry.....81

Men of the Industry.....88

Court Decisions, Commission Rulings....90

Financial and Corporate.....91

Manufacturing and Markets.....95

Business Conditions 97

Activities of the Trade.....98

New Equipment Available.....99

Construction News.....100

Electrical Patents.....102

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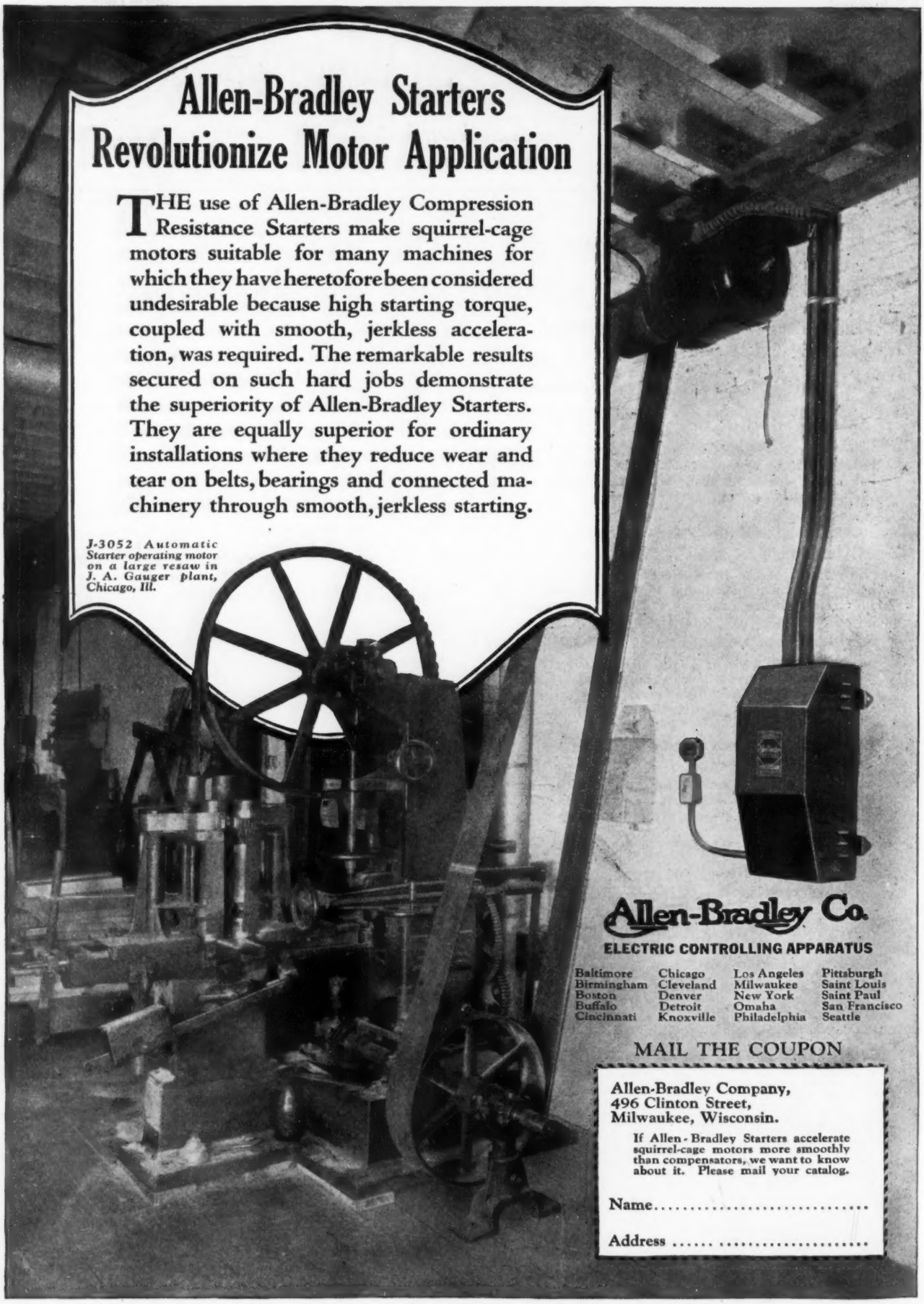

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 88 — *New York, Saturday, July 10, 1926* — NUMBER 2

New Utility Financing at Low Rates

THE condition of the electric light and power industry at the present time is reflected in the strength of its securities. New offerings of strong companies now command as low a rate as many municipal and government bonds. During June stock, bond and note issues approximated $165,000,000, as against $66,316,000 in May, bringing the total for the first half of 1926 to $750,000,000, as compared with $600,000,000 for the similar period of 1925.

Two sizable loans were offered in June bearing interest at the rate of 4½ per cent, one offering being made by the Ohio Power Company and the other by the Cumberland County Power & Light Company. The former issue, involving a total of $9,635,000 in first and refunding mortgage gold bonds, was promptly sold. The Cumberland County issue, involving a total of $9,000,000 in first mortgage gold bonds, was the third electric public utility offer so far this year carrying 4½ per cent coupons, the Commonwealth Edison Company having floated an issue of bonds bearing interest at that rate in January. Among other companies recently taking advantage of favorable monetary conditions were the Nevada-California Electric Corporation and the Southern California Edison Company, both of which have issued 5 per cent bonds to replace 6's, thereby reducing interest charges.

Guidance Needed on Legislation to Prevent Radio Interference

AS POINTED out editorially in the issue of the ELECTRICAL WORLD for March 20, listeners to broadcast radio programs have become so irritated by interference with reception that all over the country they are demanding that this interference stop. Blinded partly by their irritation, but more by their inadequate knowledge of the causes of interference, they are directing much unjustified blame upon electric utility companies. Suggestions were given in the editorial just referred to for co-operation between utility companies in doing away with this undeserved stigma. It is an important present-day element in the maintenance of public good will. More detailed help can be had from the National Electric Light Association, which has been devoting no little study to the subject.

The seriousness of the problem is indicated by a case reported under "News of the Industry." An ordinance was passed in a Nebraska city to force the local central-station company to remove all 33,000-volt lines within 90 days because of their alleged interference with radio reception. Fortunately, the City Council has since been enlightened by a fair-minded broadcast listeners' league, and it is expected that the ordinance will be repealed.

Allusion has also been made in our news columns to contemplated legislation in Iowa. No one can deny that the removal or reduction of interference will benefit every one, including radio manufacturers and distributors and electric light companies. Therefore, the purpose of the proposed legislation should be indorsed by every one. However, there is danger that the bill may be so worded as to work injustice. For example, the omission of the word "radio" before "apparatus" would directly concern utility companies, and if the legislation were copied by other states, apprehension would grow correspondingly. Utility companies cannot expect to be made immune from liability for interference, and there is every evidence that they are, within reason, willing to co-operate in removing its causes, not only because they wish to retain public good will, but because many causes of interference may come as warnings of possible service interruptions or excessive maintenance costs. If sympathy with the spirit of the proposed legislation is manifested, legislators should be found ready to welcome guidance from those with knowledge and experience.

Demonstrating Rates to the Public

FOR some years national manufacturers with plants buying energy from different central stations have been interested in comparative rates for lighting and power. More and more it has become a part of the utility management's task to demonstrate the reasons for rate differentials in different localities, and a good deal of excellent public relations work has been based upon this job. The fact that power costs in most industries are but a trifling percentage of the total cost of production has seldom saved the utility management from laborious computations justifying the local rate in the eyes of the purchaser. The existence of marked differences in the terms of power contracts and in the unit prices offered and accepted in different localities has aroused the keen interest of many an industrial and business executive, and the generally amicable relations prevailing testify that the utility industry has done a pretty fair piece of work in this particular field. In some utility organizations, indeed, it may almost be said that these rate comparisons have dropped into the class of routine industrial service.

Of late a disposition has been observed on the part of comparatively small residential and business customers to raise these same questions with regard to prevailing rates in neighboring communities served by different companies. Sometimes the companies may be interconnected and sometimes local generation and distribution prevail. A difference of a cent per kilowatt-hour in the retail price of electricity may set in motion one of these inquiries, and occasionally political axes are sharpened on such issues. To answer these demands for enlightenment of the layman in a way which he can understand is an expensive piece of work, requiring time, patience and skill, but the opportunity is a real one and should be seized with interest and enthusiasm.

It is better to grasp the problem at the outset than to wait until it reaches the regulatory commission, and in many instances a well-worked-out demonstration means the end of a particular rate agitation.

The technique of the task is at times complex, but it is always essential to present logical allocations in forms understandable to intelligent business men and to use the utmost frankness in weighting the comparative investments, overheads and running costs. Reasonable estimates of what costs would be if companies did not interchange power have their place in many of these analyses, and of course full account should be taken of comparative investments in plants, underground and overhead systems, taxes, load factors and classes of business served. All this means more work for utility managers, but here is an additional service for the power sales engineering department to perform in the joint interest of company administration and improved public relations. Finally, experience in making analyses of this kind pays good dividends in solving other problems in the perennial field of rate design and application.

Outside the "Big Top"

TO THE central-station man the N.E.L.A. convention is the grand climax of the year in organizational work. It towers mountain-high above the activities of lesser organizations with regional limitations, and yet its very magnitude precludes that intimate dealing with certain specialized problems and tasks which can be accomplished so well in smaller tents and by smaller groups. The invaluable committee work of the N.E.L.A. is of vast benefit to local utilities through their representatives participating in it, but this work must perforce be organized to focus the best current opinion of the country upon the assigned topics so as to build a national practice thereupon, and unless committees follow a carefully planned program this cannot be done. There are also limitations in time and topics which can be satisfactorily discussed in geographic section conventions and in day meetings of the sectional subdivisions.

Thus a field remains for unique achievements by local and regional groups along highly specialized lines. New England illustrates this in her system operators', electric lines, power engineers', and lighting engineers' clubs and other "consortiums," which meet perhaps six to eight times a year and combine inspections of properties with topical papers, addresses and discussions on current problems of importance. At these gatherings, which are quasi-family affairs in the territorial industry, formalities are cut out as far as can be; valuable friendships are built up through contacts at meetings and in visiting plants, service stations and offices, and because these groups are industrious and enthusiastic and out for business they accomplish great good and are in high favor with executives.

"Side shows" of the "main tent" these gatherings may be, but the "performers" know their business. Out of their programs has come in recent years a better mutual understanding which, while intangible at times, has been of the greatest value in articulating the activities of neighboring utilities. Interconnections are being handled with less trouble from frequency variations, blocks of energy are being transferred more acceptably between load centers, the competition of isolated plants is being more effectively met, safety in line work is being increased and commercial advances in illumination are being quickened because of such organizations and their common-sense handling. In some cases it might pay the supporting companies to invest more money in recording the proceedings of these meetings, for very often the material presented is too valuable to hear or see only once. Stenographic reports sometimes threaten spontaneity of discussion, but there is too much good information in meetings of this sort to let the opportunity to "salt it down" pass unimproved.

Servicing and Meter-Deposit Policies Need Harmonization

DIFFERING policies on charges for servicing equipment and on meter deposits are causing some light and power companies considerable embarrassment and difficulty in maintaining the best relations with customers. How the differences in policies become known to the public or how they originate does not matter. There is not the same justification for them that there is for differences in rates.

If these two subjects were taken up by utilities regionally or nationally, they would find that certain policies are unjustified. It should not be difficult to find a policy that would meet the requirements of most companies. However, owing to the extension of interconnections, the merger of properties and the ownership of widely separated systems by the same companies, elimination of the multitude of policies on these two practices alone and approach to standardization cannot be accomplished regionally without respect to the rest of the country. It is a case for national agreement.

Price Is Not the Important Thing

THE cost of an article does not make a great deal of difference to the man who has made up his mind he has got to have it. This is a good thought to bear in mind in appliance sales. In addition to the training of personnel for the selling and servicing of electrical refrigerators, one company defined a policy referring to the circumstances of the prospective customer—his place in the scale of wealth. It was felt that households whose income fell below a specified figure would not be interested in electrical refrigeration—in fact, could not afford it.

As the sales campaign got under way and orders came in it became very apparent that any idea that a free-born American citizen's desire or lack of desire for an electric refrigerator would depend on the figure of his yearly income was, to put it vulgarly but effectively, "all wet." The salesman discovered that the cost of the machine in dollars and cents was not the most important item in consideration.

Having expected the greatest sales resistance to be that of price, the utility company was rather mystified over the situation. Then some one dug up a piece of evidence that clarified the matter a little. Of 33,000 electric flatirons sold by this company, 3,000 were miscellaneous sales. The remaining 30,000 were put out in twelve campaigns, six on an iron selling for $6.50, four on a "four-fifty" iron and two on one selling for $7.50. The lowest-price iron had the lowest number of sales, 6,000; one and one-half times the effort on the next in price resulted in one and one-half as many sales, 9,000,

and the most expensive iron of the three, with one-half the sales effort, sold two and one-half times as well, or to the number of 15,000.

It is very evident that when any member of the great American public wants anything, he is not going to pay any attention to the words of the cold-eyed economist who tells him he can't afford it.

For Better Fractional-Horsepower Motors

WITH the increasing number of motor-driven household appliances being used, some power companies have become apprehensive over the possible effect which the high starting current, relatively poor power factor and low efficiency of certain types and makes of these motors may have upon customers' service conditions when started during normal lighting hours. They feel that some measures should be taken looking to more general use of fractional-horsepower motors of higher power factor and efficiency. Appliance manufacturers in the main look upon the electric motor only as a source of power to drive their devices and up to the present time have given little thought to its electrical characteristics, except to require that the motor manufacturers supply equipment which will operate under a wide variation of load and voltage conditions. Appliance manufacturers are also loath to increase the retail selling price of their product by using a more expensive motor. Thus between urging from central-station companies for more desirable and less noisy performance in household motors and the demand on the part of the appliance manufacturers that the motors shall produce certain mechanical effects over a wide range of service and operating conditions, at a price, the motor manufacturers find themselves in the unhappy position of trying to satisfy two divergent interests.

The electrical industry owes it to the public to supply the best equipment commercially practicable which means improvement in performance that can be made at a reasonable price. To bring this about, however, in the case of the small motor it will be necessary for the power companies, the motor manufacturers and the appliance manufacturers each frankly to recognize the problems of the others and then set about the mutual solution of these problems for the common good.

Power companies, in the first place, should conscientiously police their distribution circuits to detect and correct any conditions of low voltage, particularly in outlying districts or those which are temporary and may be caused by some local condition not always in evidence when a casual test or observation is made. Closer voltage regulation would permit material improvement in the electrical characteristics of these motors. Central-station companies should hesitate to place too rigid restrictions suddenly upon a piece of apparatus which, tacitly at least, has been acceptable for a great many years. Much can be accomplished by influencing the appliance manufacturers to produce better over-all devices and educating customers to install more adequate wiring.

Motor manufacturers should recognize the trend of central-station regulations toward lower limits on the starting current permitted for fractional-horsepower motors. Efforts to improve all characteristics of these motors at a reasonable cost should be continued. Persistent effort toward standardization of this type of equipment will eventually bring results, and the gradual elimination of an excessive number of special types to meet the requirements of appliance makers will work toward a better product and ultimate lower cost.

Appliance manufacturers can profitably look to improving the mechanical efficiency and convenience of some of their devices. Excessive starting requirements should not always be overcome merely by increasing the starting torque of the motor. Ease of inspection and oiling would help reduce the cost of servicing and add materially to the reliability and life of the device. Nor should each appliance maker insist that his motor be just a little bit different from his competitors'—it is only increasing the cost to all.

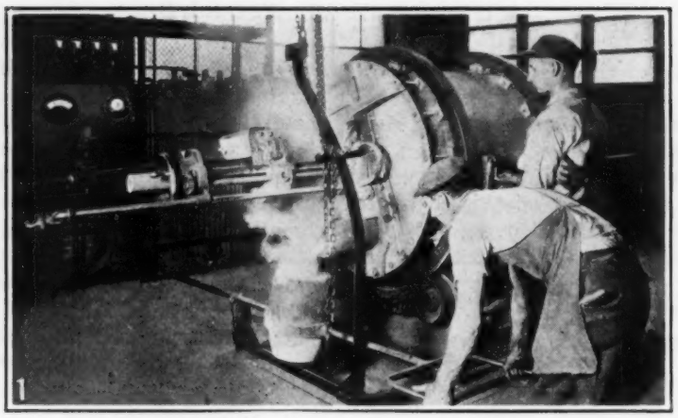
At first glance the divergence of these interests appears difficult to reconcile. Certainly they cannot be brought together overnight. But there are power companies that maintain accurate and adequate voltage, there are small motors on the market which show acceptably high performance, and there are appliance manufacturers for whom the best is none too good. With this as a starting point there is every reason to believe that the three most interested parties can get together and by putting all their cards on the table decide upon a program which will solve their mutual problems. The goal of all is service of high quality to the public.

Automobile Sales Thinking in the Electric Appliance Industry

THERE is something refreshing in the news that the Delco Light Company is embarking on a twenty-million-dollar building program to expand its facilities for manufacturing electrical refrigerators. At the same time it is announced that one hundred million dollars has been pledged by the directors of the General Motors Company, the parent organization, to support the development of the refrigeration market.

Most electrical appliance manufacturers in the past have been content with a policy of small production and high prices. But that is not the viewpoint of men schooled in the automobile industry. Starting from scratch, they have seen 17,000,000 motor cars sold in about 25 years of active marketing. And although the automobile came as a luxury costing several times as much as the equipment it displaced, it has almost swept the horse and carriage from the highways, wrought a revolution in road building, transformed the recreational habits of America and built an industry the like of which the world had never before seen. And all this not because people were consumed with eagerness to buy these newfangled conveyances, but because the automobile manufacturer backed his vision of a world on wheels with such enthusiastic advertising and such irresistible selling that they did buy.

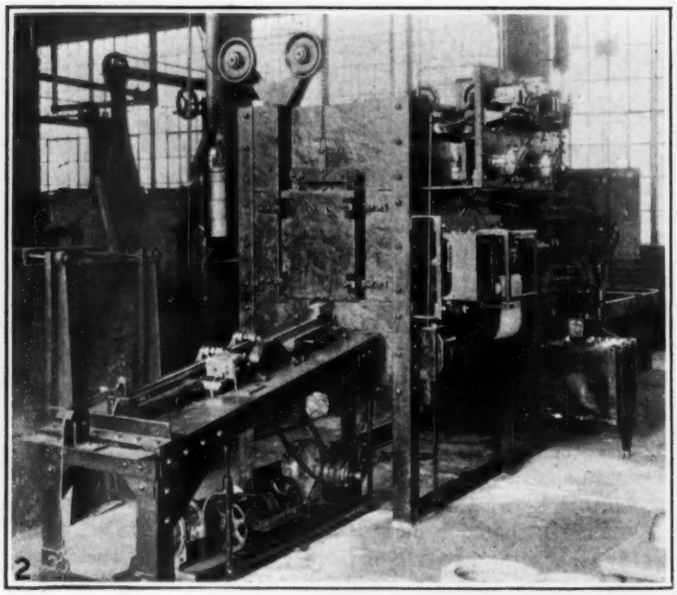
There are many interesting lessons to the electrical industry in the record of the automobile, and it is fortunate that two of the largest manufacturers of electric refrigerators are offshoots of the motor-car industry. They come into the electrical appliance field with the automobile man's naturally large ideas of the possibilities of mass production and highly organized selling. Their leadership should be watched and welcomed. For new blood brings vigor always, and the growth of the refrigeration industry is already making history in the electrical world.

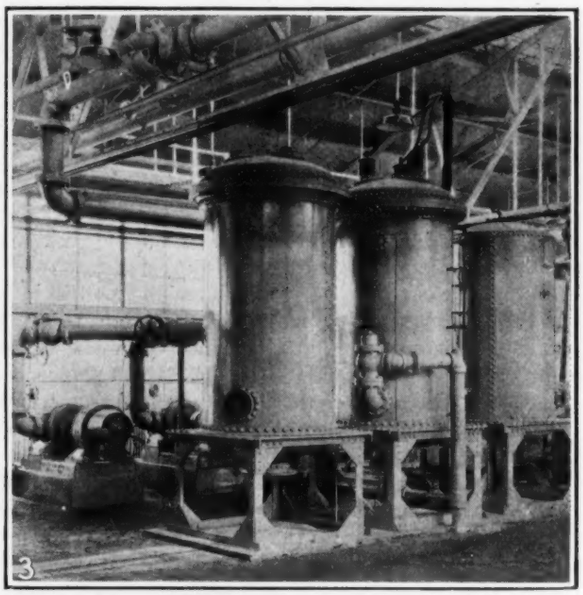


Electric Heat Advances Rapidly

THE improvement of the quality of manufactured products and the desire for quantity production to meet market competitive conditions has led to the rapid adoption of electric heat in industry. Light and power salesmen and representatives of the manufacturers of heating equipment have co-operated to introduce electric heat to industry. Schools for salesmen and the use of sound engineering principles have been adopted as fundamental to electric heat installations. Only those processes which economic and engineering analyses show to be proper fields of application have been adapted to electric heat and progress has been sound and yet rapid.

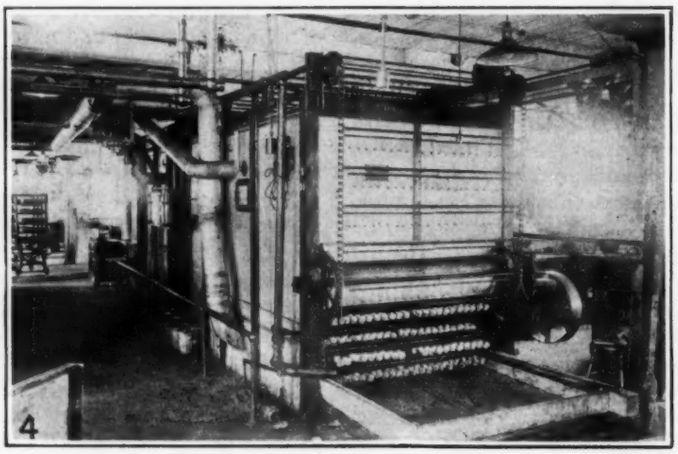
Utilities have welcomed electric heat as a good load for their systems and have co-operated in bringing the possibilities of electric heat to the attention of the manufacturers they serve.





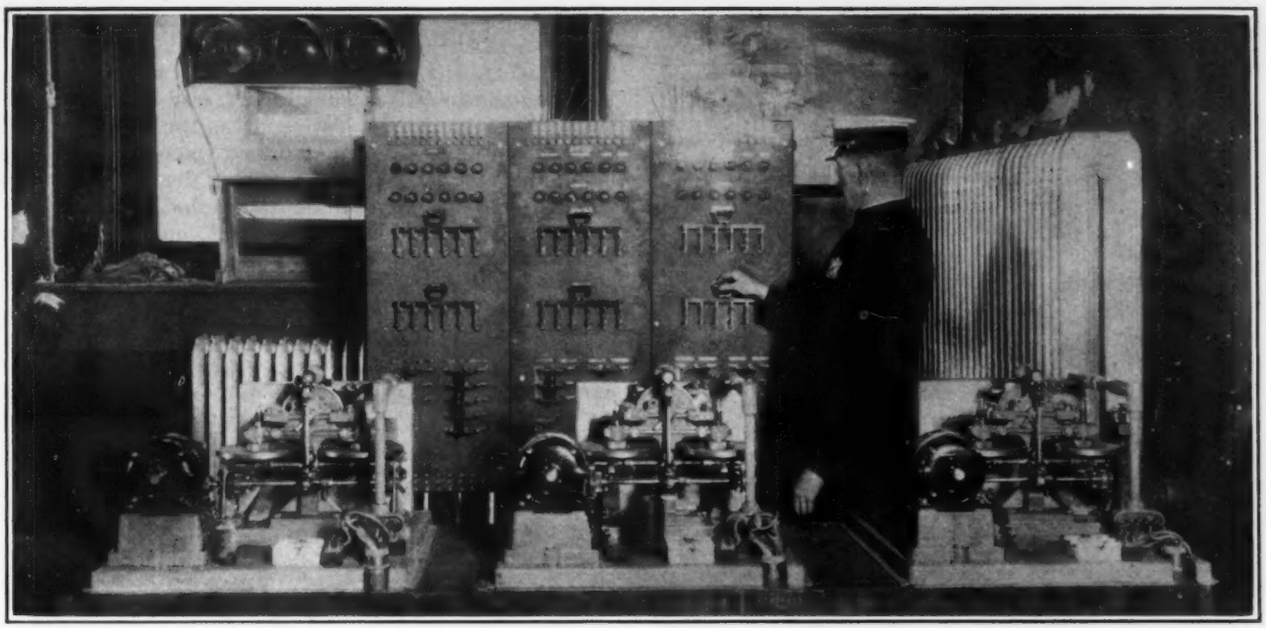
No. 1. The melting of brass—both red and yellow—has proved a fruitful field of application for several types of electric furnaces. Production, uniformity, quantity and quality have been outstanding characteristics of this application.

No. 2. High grade steels must be heat-treated very carefully. The possibility of close temperature control and flexibility in production through the use of electric heat-treating ovens has become widely recognized.



No. 3. The full development of hydro properties is economically advantageous. The electric steam boiler has proved useful for absorbing dump power from these hydro projects and for getting some return, even at a low rate, upon the site investment until loads have been developed fully.

No. 4. Continuous production without waste is favored in electric ovens for bread baking, enameling and other like processes used in industry.



CENTRAL CONTROL BOARD LOCATED AT CITY HALL

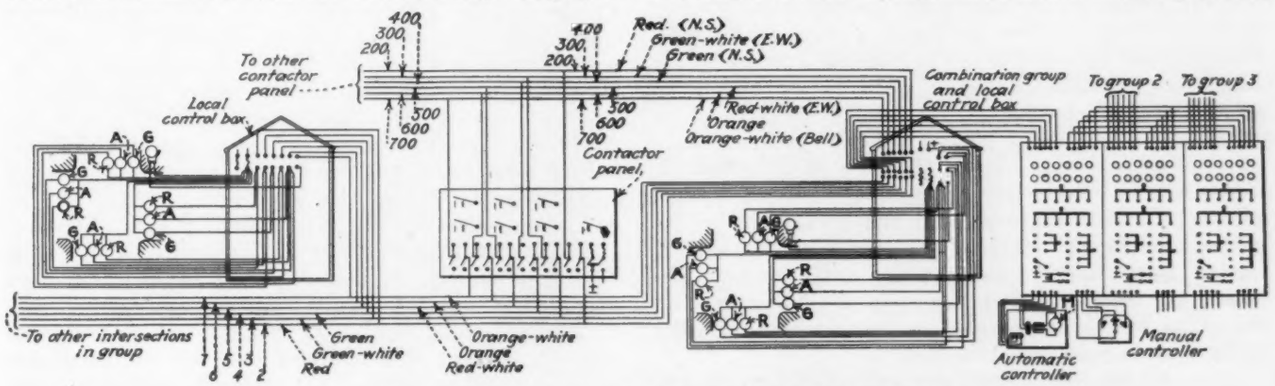
Cincinnati's Single-Control Traffic Signal System

Three Sectional Units Requiring 246 Traffic Signals Installed by the Union Gas & Electric Company for City—Method of Operation and Control

By W. L. McMAHAN
Union Gas & Electric Company, Cincinnati, Ohio

EARLY in the spring the Union Gas & Electric Company formally turned over to the city of Cincinnati the completed installation of the new traffic signal system, said to be the largest under one control in the United States, if not in the world. It includes the down-town section bounded by Fourth and Ninth Streets, Broadway and Central Avenue, an area about one mile long by one-half mile wide. Within this district there are sixty-three intersections, requiring the use of 246 standards. The system is laid out in three sectional units; in the first are included Central Avenue, Plum and Elm Streets; in the second, Race, Vine, Walnut and Main Streets; in the third, Sycamore and Broadway. Each unit is wired separately and may be operated independently, or all may be operated as one.

Four standards are placed at each intersection, one on each corner, thus providing a separate control for each of the four streams of traffic. The signals are of the three-light, horizontal type, manufactured by the Crouse-Hinds Company. Standard color symbols are used, red meaning "Stop," amber indicating "Caution" or "Change," and green signifying "Go." Ordinary 50-watt mill-type lamps are used. The standard at the northwest corner of each intersection is also provided



WIRING DIAGRAM OF CINCINNATI TRAFFIC CONTROL SYSTEM

TYPE OF TRAFFIC CONTROL STANDARD

with a bell, which may be sounded automatically with the amber, calling attention audibly to the change, or it may be rung independently of the lights if desired.

To insure complete visibility, the lights are mounted on brackets extending over the curb and at a distance of 14 ft. from the street level. The lights are hooded, according to the usual practice, which not only makes them easily seen on bright days, but makes it possible to see them only from the direction for which they operate, thus preventing confusion to opposing traffic.

As the accompanying illustration shows, the standards are of attractive design, harmonizing with those used for the boulevard lights recently installed throughout the city by the Union Gas & Electric Company. The ornamental spear heads above and below the lights are removable, so that street name-plates and other traffic directions may be attached as required.

RIGID STANDARDS USED

Another illustration shows an erection crew placing an ornamental cast-iron shell over a steel center pole. This method of construction gives the standards the rigidity to withstand shocks to which they are likely to be subjected by collision. The steel poles are set in concrete to a depth of 4 ft. and are filled with the same material some distance above the level of the sidewalk.

The heart of the system is the control board, located at the City Hall and regulated and supervised by the police department. There is a panel and automatic timing apparatus for each of the three units. The panels are interconnected, however, so that in practice the entire system is operated by one machine, in order to have all signals synchronized.

These timing instruments are subject to very flexible adjustment. Direction changes may be made from fifteen seconds to two minutes apart; red lights may be shown throughout the entire area, thus stopping all traffic, as in case of fire or other emergency, and by using more than one timing machine, the separate units may be operated on different schedules. Only by experiment can the best method of operation for a particular community be determined, as traffic conditions are not the same in any two cities.

Supplementing general control at the City Hall, each of the three units may be taken off the automatic control and operated manually by a police officer within the particular area. Any intersection may also be operated by hand, through a control box mounted upon the standard at the northwest corner. If desired, the entire

METHOD OF INSTALLING ORNAMENTAL SHELL OVER STEEL CENTER POLE

system may be operated by a hand lever at the central control station. These provisions for manual control are of great importance in emergencies, particularly fire.

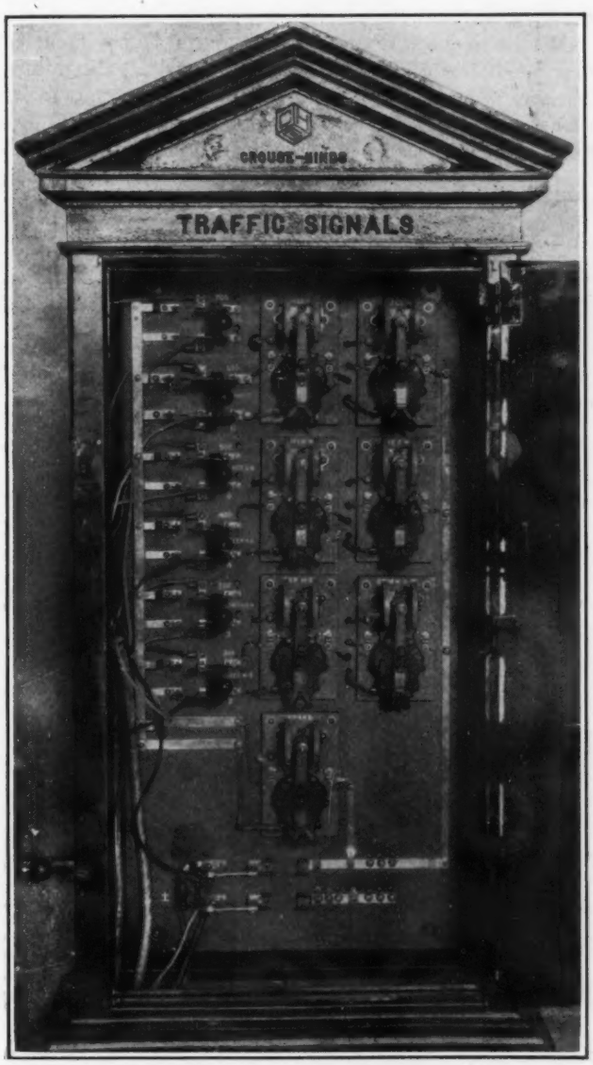
It will be noted from the wiring diagram that a spare contactor is provided in each of the five panels required by the system. It should also be mentioned that an emergency cable is laid through most of the conduits, not shown in the diagram, which extra equipment permits repairs or adjustments to be made without interruption to operation. Rearrangements of the wiring connections, such as necessary for staggering the signals, for instance, may be done in the manual control boxes at each intersection, making it unnecessary to enter the manholes. The advantage of this is obvious.

The contract between the city and the Union Gas & Electric Company was made on the basis of installation and maintenance for a period of ten years, at a yearly rental of $165 per signal. Construction work proceeded immediately and was accomplished without hindrance or delay to traffic, most of the underground work at the

intersections being done at night. One of the difficulties encountered lay in the fact that a great many of the boulevard light standards at the intersections were in such positions that they would have interfered with clear vision of the signals, and therefore had to be moved, thus requiring considerable additional underground work.

During the time the signal proposal was under consideration, a thorough study of traffic control was made by city officials, working in collaboration with engineers of the Union Gas & Electric Company. Every large city in the United States and several in Canada and Europe were visited, and close study was made of methods of handling similar problems in those municipalities. The new system in Cincinnati is believed to comprise the most modern features of city traffic control that have been developed.

The system has been in operation for several months and has aided traffic movements materially. No test surveys have yet been made to determine actual time elements for traffic movements and some modification of timing may be made in the light of operating experience over a period of several months. Since the system is flexible in its control arrangements it can be adapted to traffic needs as traffic changes occur.



CONTROL BOX MOUNTED ON STREET STANDARD FOR MANUAL CONTROL

Rural Service Rapidly Increasing in Alabama

Development of Rural Service in Conjunction with Alabama Polytechnic Institute—Tests Now in Progress to Analyze Rural Uses of Energy

ON SEPT. 1, 1925, there was 138.5 miles of rural lines in Alabama with 1,370 customers. At that time there was under construction or authorization an additional 117 miles of rural lines to which will be connected 1,299 customers. This makes a total of 255.5 miles now operating, counting this increase during the first six months of 1926.

TYPICAL RURAL LINE CONSTRUCTION IN ALABAMA
6,600-volt line with 275-ft. spans and No. 6 bare copper primary. (Huffman Project.)

This rural electrification work in Alabama is being done through a co-operative agreement, made just prior to Jan. 1, 1924, between the agricultural engineering department of the Alabama Polytechnic Institute and the Alabama Power Company. According to the original agreement, the power company was to construct, maintain and operate at least three lines in different sections of the state for conducting field investigations. The agricultural engineering department was to collect and record the data, assisted by the power company engineers and through co-operation with rural customers receiving service. After the work was begun

TABLE I—GROWTH OF RURAL LINES IN ALABAMA

Date	Length of Lines, Miles	Customers	Per Cent Increase: Length of Lines	Per Cent Increase: Customers
Jan. 1, 1924.....	38.9	240		
Jan. 1, 1925.....	78.2	771	101	221
Sept. 1, 1925.....	138.5	1,370	77	78
Sept. 1, 1925.....	255.5*	2,666*		

* Total completed, under construction and authorized.

it was found that many more rural communities were interested and in position to obtain electric service than had been anticipated. As a result there has been a very rapid growth of rural lines in the state. This is shown in the figures given in Table I.

The first rural line constructed by the power company was completed in June, 1920, to serve a cotton gin and ten farmers in Madison County near Huntsville. Since that time and previous to Jan. 1, 1924, there were added to the company system fifteen rural lines, a total distance of 32.9 miles, to serve 230 customers. During 1924 there was 39.3 miles of lines constructed to serve 531 rural customers, and in the first eight months of 1925, 60.3 miles of lines was built to serve 599 customers. On Sept. 1, 1925, there was under construction or authorization 117 miles of line to serve an additional 1,296 rural customers. The rural lines now extend into nineteen of the sixty counties of the state.

Unlike most of the other states conducting experiments in rural electrification, there are no artificial conditions created in the field with rural customers. The customers use only the equipment that they are willing to purchase and use at the regular price for equipment, and pay for current used. Consequently the power company and the agricultural engineering department are learning what the farmers can do with electricity and how they will use it.

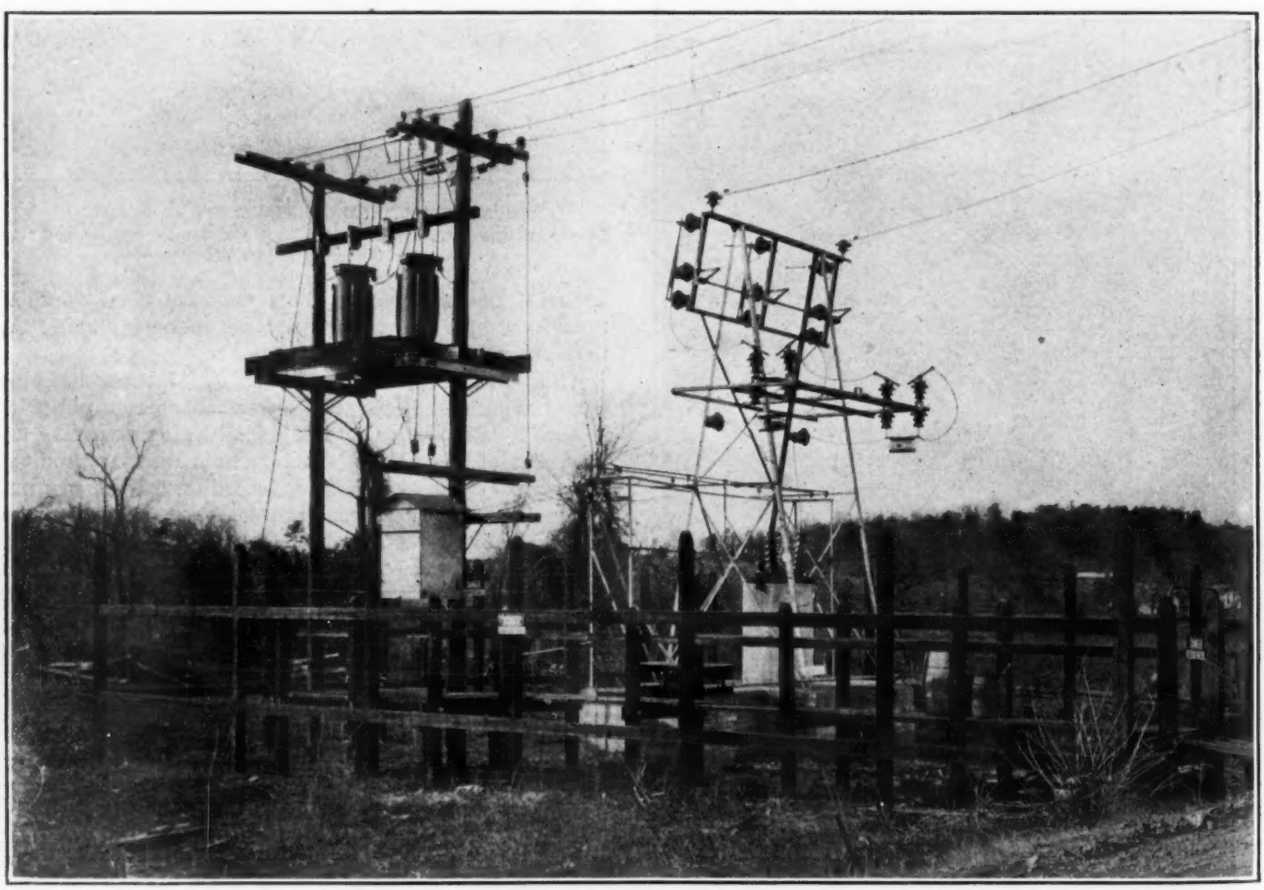
Analyses are being made of the different types of farms in different agricultural sections of the state, with special reference to the farm power problems. An analysis is also being made of each individual use that the farmers are making of electricity to determine its cost and value to the power company and to the farmer. In addition to lighting farmhouses, barns and yards, energy is being used for 38 different purposes by Alabama farmers. Records are being made of each of these operations, as to energy consumed and cost.

M. J. Funchess is the director of the Experiment Station at the Alabama Polytechnic Institute, and M. L. Nichols is head of the agricultural engineering department. Active field work in rural electrification is being done by E. C. Easter, associate agricultural engineer.

TABLE II—SURVEY OF RURAL DISTRIBUTION LINES IN ALABAMA

County	Constructed, Sept. 1, 1925 Projects	Length of Lines, Miles	Customers	Under Construction or Authorized Projects	Length of Lines, Miles	Customers
Autauga	4	2.4	15	1*	15.0	107
Bibb	..	....	...	1	1.3	10
Butler	1	6.4	21	..	....	...
Chambers	1	5.3	81	..	....	...
Cleburne	..	....	...	1	16.5	279
Chilton	2	2.2	20	1	11.0	179
Dallas	1	4.0	51	..	....	...
Elmore	3	21.9	261	1	3.3	23
Etawah	2	4.5	7	..	....	...
Jefferson	9	45.6	651	3	25.2	203
Lamar	..	....	...	1	10.0	134
Lawrence	..	....	...	3	15.3	181
Lowndes	1	2.2	37	..	....	...
Macon	1	0.5	4	1	8.4	72
Madison	5	15.6	39	..	....	...
Montgomery	12	17.8	114	..	....	...
Shelby	..	....	...	1	11.0	108
Talladega	4	7.3	31	..	....	...
Tallapoosa	1	2.8	38	..	....	...
Total	47	138.5	1,370	14	117.0	1,296

* Part of this project is in Chilton County.



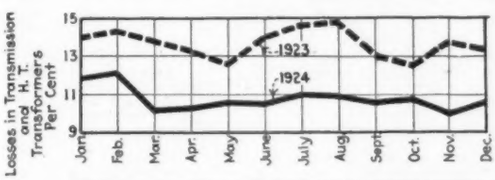
OUTDOOR SUBSTATION, 44,000/6,600-VOLT, FOR SERVICE TO RURAL LINE (HUFFMAN PROJECT)

Savings from Power Factor Correction

British Columbia Electric Railway Company Saves Approximately $120,000 Annually by Power Factor Correction—The Necessity for Additional Generator Capacity Obviated

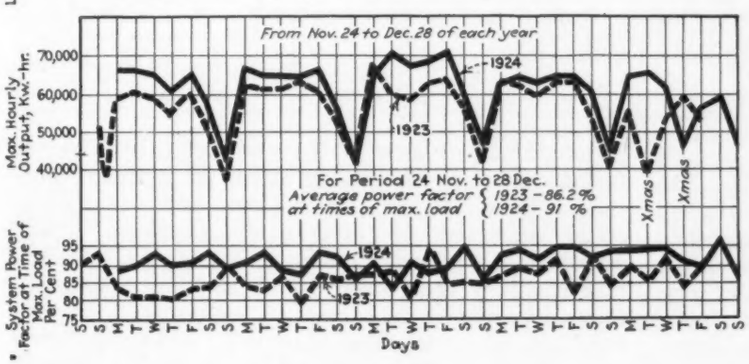
By R. L. HALL
Assistant Electrical Engineer
British Columbia Electric Railway Company, Vancouver, B. C.

ALTHOUGH there had always been power factor clauses embodied in contracts between the British Columbia Electric Railway Company and its larger power customers prior to 1921, these had never been enforced, and it was only after an analysis at that time which showed the amount of revenue lost from poor power factor that the seriousness, from a financial standpoint, of low power factor was realized. At that time it was found that the system peak power factor was 82 per cent and that the peak load kilovolt-amperage was approaching very closely to the total generator capacity of the system, so that additional generator capacity was urgently needed to care for the normal growth of load.



LINE AND TRANSFORMER LOSS IMPROVEMENTS

The first step taken to improve the situation was a complete analysis of customers' loads of 50 hp. and over. Tests were made at each customer's plant to determine the power factor, maximum demand and load in kilowatts during a normal day's operation. These tests were made with indicating instruments, but a more elaborate method of testing was later used. Full data as to length of feeders to distribution points, size and spacing of wires and the total weight and cost of copper, together with voltage drop and regulation of each feeder, were then calculated, and the economies that could be effected in copper outlay, should the power factor be raised to 90 per cent, were tabulated. The method of compiling all this information is shown on page 62. Careful study of the chart revealed the feeders that had poor power factor and also showed the customers responsible for the conditions.



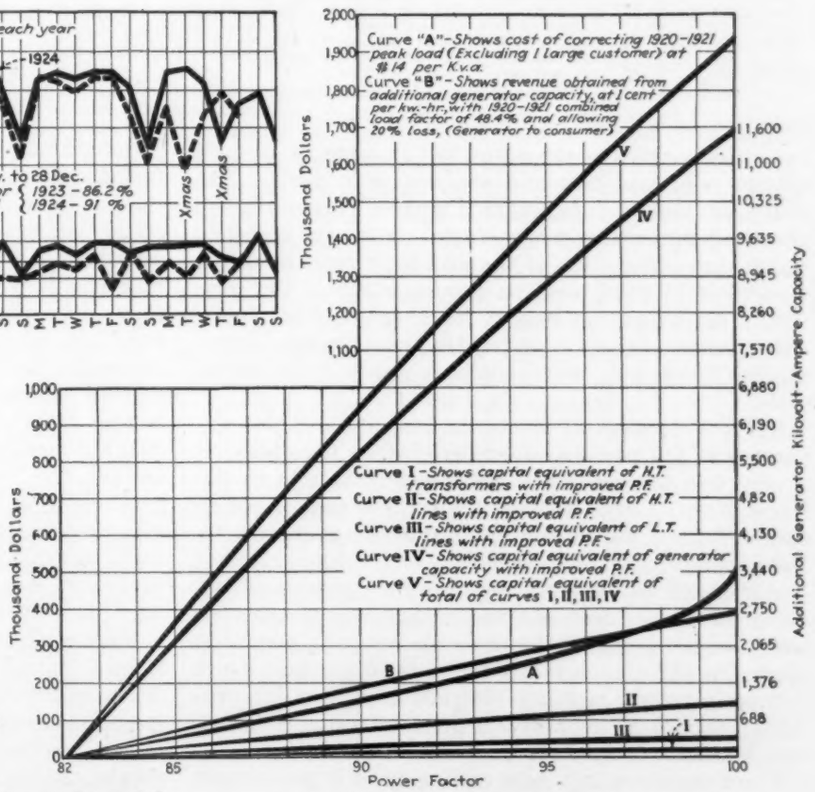
	1923	1924
Total generation (Kw.-hr.)	279,336,364	300,456,350
Input to transmission system	266,184,454	294,276,907
Output of transmission system	225,391,246	262,448,628
Loss in transmission system	35,793,208	31,828,279
Per cent loss	13.7%	10.8%

Applying 1923 rate of loss to 1924 load the following results are obtained

294,276,907 Kw.-hr. at 13.7% = 40,315,936 Kw.-hr.
294,276,907 Kw.-hr. at 10.8% = 31,828,279 Kw.-hr.
Kw.-hr. economy = 8,487,657 Kw.-hr.

	Nov. 24 to Dec. 28 1923	1924
Average peak load =	55,500	60,228
Increase of average peak load =		8.4%
Maximum peak load =	67,200	70,900
Increase of maximum peak load =		5.5%

CURVES OF POWER FACTOR IMPROVEMENT AND PEAK LOAD INCREASE



SAVINGS TO BE EFFECTED BY RAISING SYSTEM POWER FACTOR

However, at this time, as stated before, the conditions were rather critical as regards the total generator capacity being inadequate to meet the system kilovolt-ampere peak. In order to emphasize the absolute necessity of obtaining immediate relief and to justify, from a financial standpoint, the installation of part of the

Method of Tabulating Data Gathered

Customer	Address	Motors	Hp. Installed: Total, Hp.	Remarks
1. Van. Ice & Cold Storage	Gore Ave., Vancouver	2/2, 1/4, 6/5, 1/7½, 2/11, 3/15, 1/75, 1/100, 1/400, 1/10	697½	Cold storage
2. Martin & Robertson	329 Railway St., Vancouver	1/35 Rice Mill, 2/7½, 1/5, 1/75	50	Factory
3. Imperial Rice Mills	Railway St., Vancouver	2/75	150	Milling
4. Crown Broom Works	Front St., Vancouver	4/5, 1/7½	27½	Factory
5. Dowling Mfg. Company	Dufferin St., Vancouver	1/10, 1/15	25	Factory
6. United Grain Growers	Front St., East Vancouver	1/5, 2/10, 3/20, 1/30	115	Grain mill
7. L'Air Liquide Co	5th Ave. and Yukon, Vancouver	2/2, 1/7½, 1/30, 1/100	141	oxygen & acetylene company
8. South Shore Lumber Co	1 Front St., Vancouver	1/35, 1/75	110	Lumber mill
9. Canada Box Co	101 Dufferin St., Vancouver	5/5, 1/7½, 1/10, 1/15, 2/35, 1/90, 1/50	217½	Box factory
10. Arbuthnot S. & D. Factory	101 Dufferin St., Vancouver	2/5, 2/10, 1/12, 1/20, 1/25	87	Sash and door mill
11. B. C. Box Co	294 Front St., Vancouver	1/5, 3/30, 1/35	130	Box factory
12. Fraser Valley Dairies, Ltd	8th Ave. and Yokon, Vancouver	3/1, 7/2, 5/5, 1/7½, 1/15, 2/25, 1/30	144½	Creamery
13. Compressed Gas Co	1530 Hastings, East Vancouver	1/3, 1/5, 1/15, 2/75	173	Driving d. c. generator
14. H. Hori	821 Powell St., Vancouver	2/15, 1/30	60	Rice mill

Static Condensers Required to Give 90 Per Cent P.F.		Synchronous Motors Required to Give 90 Per Cent P. F. Kva. Output Kw. Mechanical Load	Feeder Economics						Feeder	Length (1 Wire) in Thousand Ft. to Distribution Point
Kva. Output	M. Farads		Load, Kw.	P.F. Per Cent	Per Cent Bus Voltage Drop	P.F. Per Cent	Per Cent Bus Voltage Drop	Volts Drop, Per Cent Savings		
Taking the load 200 kw. at 42.8 P.F. say 300 kva. at (2,400 volt)	138	(On 200-kw. load. Taking say Van. Ice Co., 400 hp., a 150-kva. syn. motor carrying 140-kw. load and 47-kva. wattless excited to 94.9 per cent leading, will correct to 90 per cent P.F. lagging, or a 310-kva. condenser will correct 309-kva. wattless if excited to 0.035 per cent. P.F. leading and no mechanical load. (On load 340 kw.). Taking say the 100-hp. motor at the L'Air Liquide Co., a 170-kva. syn. motor carrying 105-kw. load and correcting 134 kva. wattless, excited to 61.8 per cent leading P.F. will correct feeder to 90 per cent P.F., or taking two motors with above equivalent load and P.F., one 100-kva. syn. motor carrying 61.5-kw. mech. load over-excited to 58.6 per cent leading P.F. will correct 80 kva., together with a 70-kva. motor carrying 43½-kw. load excited to 62.7 per cent leading P.F. will correct 54 kva. and final feeder P.F. will be 90 per cent lag.			2.98		1.12	1.86		
			200	42.8	72 V.	90	27 V.	45 V. i.e. 2668 times present load could be carried for the same voltage drop as at present.	F 18	3.2
Taking the load 340 kw. at 67.1 per cent P.F. say 200 kva. at (2,400 volt)	92				2.98		1.86	1.12		
			340	67.1	72 V.	90	45 V.	27 V. i.e. 1.6 times present load could be carried at 90 per cent P.F. for the same voltage drop.	F 21	3.0

necessary corrective apparatus by the company, a total system peak load test and analysis were made. The curves on page 61 were prepared to show graphically the effect of improving power factor from an economic standpoint. The value of the generator capacity saved was taken at $120 per horsepower, which is the company's actual cost at one of its hydro-electric plants. Other items, such as high-tension transformers, transmission lines, etc., were similarly taken from actual costs.

Curve *A* on page 61 shows the cost of corrective apparatus at $14 per kilovolt-ampere, which is considered a very fair allowance for motor-generator sets in the larger sizes. Curve *B* shows the revenue that would be obtained from selling the kilowatt-hours generated by the generator capacity saved due to the higher power factor and is calculated by allowing for a combined load factor of 48 per cent and an average cost of one cent per kilowatt-hour. From these curves it is seen that correcting the system power factor to 90 per cent would release generator capacity that could be used for producing salable kilowatt-hours, the total value of which would amount to $190,000 annually.

From the foregoing tests and analysis it was clearly seen that great benefits were to be derived from power factor correction, preferably at the customers' services, but as this would require several years to accomplish, immediate relief was obtained by the installation of two motor-generator sets, one unit comprising a 6,000-kva. synchronous motor driving a 1,000-kw. generator used for supplying commercial direct-current power, and the other a 3,750-kva. synchronous motor driving a 1,000-kw. generator for furnishing direct-current railway service.

*Upper and lower halves of tabulation are continuous.

Referring back now to the year 1921, when power factor correction was inaugurated, the company purchased three 250-kva., one 75-kva. and one 25-kva. static condensers for experimental purposes. These were installed on two of the most heavily loaded feeders that had very poor power factor, and the results obtained in reducing the current on the feeders were very gratifying and stimulated effort to go still further into the matter from the customers' standpoint. Four two-element wattmeter sets were purchased and put to work testing customers' services. One unit in these instruments measures kilowatt-hours on the integrating dials and at the same time measures the kilowatt-hours graphically in fifteen-minute demands. The other unit measures reactive kilovolt-ampere-hours, both graphically and integrating. A complete survey of customers' loads was made and all data were gathered and tabulated in convenient form.

Four methods of correcting power factor were considered, outside of the obvious one of replacing underloaded induction motors—viz., synchronous condensers, synchronous motors, static condensers and high power factor motors. In any particular case the best apparatus to use is, of course, determined by cost, which determination requires a thorough investigation at the plant of the customer and the consideration of the several means of correcting power factor from an economic standpoint. With a view to speeding up the analysis of a plant the chart shown on page 64 was prepared. This shows the cost of various corrective apparatus, f.o.b. Vancouver, B. C.

From the curves presented it will be seen that the cheapest apparatus between 125 hp. and 350 hp. (92½ kva. and 260 kva.) is high-speed, 1,800-r.p.m., synchronous condensers, which vary in cost from $20 to

in Power Factor Analysis*

Observed Max. Load, Kw.	Power Factor	Supplied from Feeder	P.F. and Kw. on Feeder Between 3 P.M. and 6 P.M.						Kva. Wattless on Feeder Between 4 P.M. and 6 P.M.				Kva. Correction Required to Give 90 Per Cent P.F. on Feeder			
			July 7th			July 8th			July 7th		July 8th		July 7th		July 8th	
			Time, P.M.	P.F. Per Cent	Kw.	Time, P.M.	P.F. Per Cent	Kw.	Time, P.M.	Kva.	Time, P.M.	Kva.	Time, P.M.	Kva.	Time, P.M.	Kva
132	0.5	Van. Ice Co. 3. F18 S8 Van. sub.	3 to 4	45.7	210	3 to 4	49.5	220	3 to 4	408	3 to 4	385	3 to 4	307	3 to 4	280
13.2 kw. Rice M	0.74 Rice M		4 to 5	42.8	200	4 to 5	44.5	190	4 to 5	421	4 to 5	382	4 to 5	325	4 to 5	290
4.5 kw.-hr.	0.3 Elev.[3]	Van. Ice Co. 3. F18 S8 Van. sub	5 to 6	44.3	190	5 to 6	45.7	190	5 to 6	384	5 to 6	368	5 to 6	292	5 to 6	276
101	0.85	Van. Ice Co. 3. F18 S8 Van. sub.														
8.5	0.84	Mt. Pleasant 3. F21 S11 Van sub.		July 7th		July 8th			July 7th		July 8th		July 7th		July 8th	
3.6	Unbalanced	Mt. Pleasant 3. F21 S11 Van. sub.														
38	0.76	Mt. Pleasant 3. F21 S11 Van. sub.	Time, P.M.	P.F. Per Cent	Kw.	Time, P.M.	P.F. Per Cent	Kw.	Time, P.M.	Kva.	Time, P.M.	Kva.	Time, P.M.	Kva.	Time, P.M.	Kva.
105	0.8	Mt. Pleasant 3. F21 S11 Van. sub.	3 to 4	67.1	340	3 to 4	71.4	370	3 to 4	376	3 to 4	363	3 to 4	212	3 to 4	185
32	0.8	Mt. Pleasant 3. F21 S11 Van. sub.	4 to 5	61.6	270	4 to 5	69.2	310	4 to 5	345	4 to 5	323	4 to 5	215	4 to 5	174
70	0.74	Mt. Pleasant 3. F21 S11 Van. sub.	5 to 6	62.3	170	5 to 6	73.5	150	5 to 6	213	5 to 6	139	5 to 6	131	5 to 6	67
31	0.55	Mt. Pleasant 3. F21 S11 Van. sub.														
110*	Max. Dem. Apr., 1921	Mt. Pleasant 3. F21 S11 Van. sub.														
50	Unbalanced	Mt. Pleasant 3. F21 S11 Van. sub.														
153	0.93	East End 3. F22 S12 Van. sub.														
25	0.7	East End 3. F22 S12 Van. sub.														

Feeder Copper Saved by Raising P.F. to 90 Per Cent					Customers' Consumption for May to June, 1921		Discount	Net Charge	Net Charge if P.F. Clause Enforced	Deficit in Charge	Date of Watt-Hr. Meter Reading	
At 770 Lb. per 1,000 Ft. Total Weight of Present Feeder	At 26c. per Lb. Total Copper Cost of Present Feeder	No. of Times Present Load Can Be Carried if Feeder Operated at 90 Per Cent P.F.	No. of Times Value of Copper in Feeder if Raised to 90 Per Cent P.F.	Cost of Copper Saved if Feeder Was Raised to 90 Per Cent P.F. for the Same V. Drop as at Present P.F.	Kw.-Hr.	Amount Gross						
					81,924	$758.61	$144.09	$614.52	$664.72	$150.20	.....	1
7,392 lb.	$1,922.00	2.668	1.668	$3,205.00	8,171	163.42	None	163.42	184.57	21.15	26/4 to 4/7	2
					16,330	269.47	None	269.47	O.K.	.....	3/6 to 7/7	3
					1,200	24.00	None	24.00	24.28	0.28	8/6 to 12/7	4
					1,320	35.40	None	35.40	.....	.....	8/6 to 12/7	5
					New tenant reduction of load by 70 hp.							6
					11,110	172.70	None	172.70	182.85	10.15	31/5 to 30/6	7
					4,980	100.00	None	100.00	105.88	5.88	25/5 to 27/6	8
					12,340	228.67	None	228.67	258.25	29.58	25/5 to 27/6	9
6,930	1,802.00	1.6	0.6	1,081.00	5,190	38.92	None	38.92	52.66	13.74	25/5 to 27/6	10
					9,140	141.40	None	141.40	.....	.....	25/5 to 25/6	11
					22,670	238.48	None	238.48	.....	.....	31/5 to 2/7	12
					35,000	339.90	None	.....	.....	.....	6/6 to 7/7	13
					2,232	71.82	None	71.82	84.50	12.68	8/6 to 7/7	14

$14 per kilovolt-ampere. Slower speed synchronous condensers of 1,200 r.p.m. are available between 100 hp. and 500 hp. (75 kva. and 375 kva.), varying in price from $25 to $13.50 per kilovolt-ampere, and these are competitive with 550-volt and 2,200-volt static condensers of similar capacities, as will be seen from the chart. Synchronous motors are somewhat higher in price, varying from $46 to $25 per kilovolt-ampere for sizes between 100 hp. and 250 hp. and $32 to $28 for sizes between 250 hp. and 500 hp. This, of course, is on account of the more rugged type of machine required to carry the mechanical load as well as the wattless. In the lower capacities of 7 hp. to 100 hp. (5 kva. to 75 kva.) the static condenser prices vary from $50 to $25 per kilovolt-ampere. The reason for the hump in the 550-volt static condenser curve is that between the sizes of 5 kva. and 20 kva. an ordinary knife switch can be used for connecting the condenser to the line, whereas for sizes above 20 kva., oil circuit breakers are employed, which adds considerably to the initial investment. Likewise the 2,300-volt static condensers are costly in the smaller sizes.

It will be seen that the high power factor motor considered is considerably greater in cost than any of the other class of apparatus—in fact, it is approximately double the price of an ordinary squirrel-cage motor—but its field of application is quite extensive between the capacities of 10 hp. and 100 hp., as it is used to replace induction motors that would have to be installed. At the same time it is correcting power factor, so that all of the total initial cost cannot be charged against power factor correction.

There is one point that must not be overlooked in analyzing a plant for its required corrective apparatus, and that is the running or energy charges which the apparatus will absorb. Allowing a liberal estimate of 95 per cent efficiency for any of the rotating apparatus—that is, synchronous motors, synchronous condensers and high power factor motors—the yearly kilowatt-hours required to run the machines will be ten times more than that required for static condensers, as the losses of a static condenser are only 0.5 per cent. When the fixed charges of the initial investment have been ascertained, the running or energy charges should be calculated, and a balance drawn over a period of years to determine which is the most economical.

SAVINGS EFFECTED

After all preliminary work had been completed and customers were installing corrective apparatus, it was not long before the benefits were being felt on the distribution system and power plants. The method of requiring customers to correct their power factor was as follows: After tests have been made, the customer's attention is called to the power factor clause in his contract, and the various means at his disposal for correcting power factor are explained. Every assistance is given the customer by the company's engineers, and he is allowed from three to six months to rectify the condition. If no action is taken he is billed with the power factor clause enforced—that is, his bill is augmented by the formula,

$$\frac{\textit{Rate} \times \textit{power factor required}}{\textit{Power factor obtained}}$$

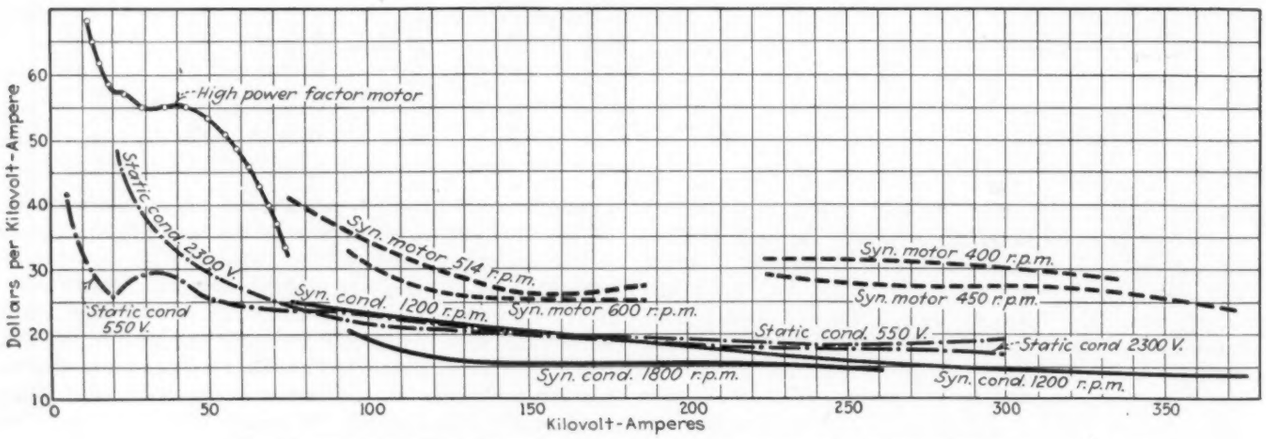
This generally leads to action on his part immediately.

The tangible results accomplished from power factor correction are shown in the middle group of curves on page 61. The lower set of curves shows power factor improvement over the period of yearly peak, which is

between Nov. 24 and Dec. 28, 1924. The curves are plotted for this period from the daily peak load power factors, and the average during the whole period was calculated from these data. The average for the year 1923 was 86 per cent, and for the year 1924 it was 91 per cent.

The upper set of curves in this group shows the daily increased peak loads of 1924 over 1923, and is an indication of the increase of the system load. The maximum peak load increase of 1924 over 1923 was 5.5 per cent, whereas the average peak load increase during the period of Nov. 24 to Dec. 28 was 8.4 per cent. The top set of curves shows the improvement made to the losses in transmission lines and high-tension transformers. The improvement between January and February was due to the static condensers and other corrective apparatus that had been installed in customers' plants during 1923. The big drop between February and March, and from March on, was due to the synchronous condensers at Main Street and Burnaby substations being started up at this time. The average loss for 1923 was 13.7 per cent and the average loss for 1924 was 10.8 per cent of the total generated kilowatt-hours. However, the output for 1924 was approximately 11,000,000 kw.-hr. more than the output for 1923, so that equating each year to the same output it means that there was a direct saving of approximately 8,500,000 kw.-hr. made during the year of 1924, due to power factor correction. This figure was increased during 1925 to 11,700,000 kw.-hr., as it will be noted that the synchronous condensers were available for only ten months of the year 1924, whereas they were running for the twelve months of 1925.

Thus it will be seen that during 1925 there was 11,700,000 kw.-hr. available for sale that would otherwise have been dissipated as heat. Assuming this energy to be worth one cent per kilowatt-hour at the generating plants, it means that $117,000 more was realized from the given plant rating than would have been the case without power factor correction. Therefore the British Columbia Electric Railway Company feels that results obtained have fully justified the time and money spent in bringing them about.



COST CURVES FOR POWER FACTOR CORRECTIVE APPARATUS, F. O. B. VANCOUVER, B. C.

ULTIMATE SOLUTION OF POWER FACTOR PROBLEM

The author is of the opinion that the only really satisfactory solution to the power factor question is for induction motors to be equipped with static condensers of the proper capacity to raise the power factor of these motors under average operating conditions to the desired value.

When induction motors were first utilized commercially, it was not uncommon practice to throw them directly on the line without the use of compensators, but this soon caused the operating companies to object to such practice, as it interfered with line regulation too severely, and from the storm of protest that arose, it was not long before it became compulsory to include a starting compensator with the motor. From that time to the present the two pieces of apparaus have been bought by the user as a unit and the capital investment written off as a unit. In this way the manufacurers rectified the trouble by including a starting compensator as a part of the motor. Starting compensators do not benefit the customer except indirectly and a much more direct benefit would come to him from the correction of his poor power factor, which not only is giving him poor line regulation and voltage but is causing more kilowatt-hours to be used by reason of increased I^2R losses.

Why not, then, let the manufacturers solve the problem from an engineering standpoint by incorporating the correction required as part of the motor equipment, just as they do with starting compensators? This correction could be in the form of static condensers connected to the motor terminals. There is a trend in this direction, and one large manufacturer is now making such equipment, but why not let the system be standardized and adopted as a part of the A.I.E.E. rules, rather than attempt power factor correction through commercial departments, which have to apply power factor clauses or make special power factor rates, all of which are more or less confusing and unsatisfactory to consumers?

Business Facts Colors Interchanged

THROUGH an unfortunate error the colors in the diagram on page 51 of the July 3 issue of ELECTRICAL WORLD were interchanged, so that the information as given is incorrect. The sections of the circles shown in blank should have been in color and refer to present central-station connected load, while the colored sections should have been shown blank and refer to the available central-station connected load which is only waiting to come on the lines.

Essentials of Modern Street Lighting

Safety of First Importance, Ornamentation and Advertising Value Also Desirable—Strong Silhouette Effect with Feeble Vertical Illumination Not Sufficient—How Desired Effects Can Be Produced

By C. J. STAHL
Manager Illuminating Engineering Bureau,
Westinghouse Electric & Manufacturing Company, South Bend, Ind.

DETERMINATION of what form of street lighting is best must take into consideration the illumination requirements for clear vision and what objects must be made visible. Vision involves the illumination of objects so that the details on the surface are rendered discernible, or so that the outline and approximate location of the object is made perceptible by its contrast with the background. Direct lighting and silhouette effects are seldom entirely dissociated and neither alone results in clear observation. Shadows are but areas of obstructed light and make it difficult to judge the exact location, motion and intent of the object. If silhouette effect is depended upon primarily, there is delayed perception, uncertain interpretations and dangers of misjudgment. Street lighting producing strong silhouettes but feeble illumination tends little to decrease and may even increase the hazards of modern street traffic. Ample direct illumination should also be provided.

Is it the surface of the street or objects on or above the street that should be brought to view? To the automobile driver extreme irregularities in the surface of the street may become a source of danger or at least discomfort. Such irregularities, however, are plainly noticeable even when poorly illuminated, for depressions in the street surface appear dark and in strong contrast with the normal surface. Illumination that reveals such irregularity might not, however, enable accurate observation of vehicles and pedestrians.

The natural conclusion is that moderate horizontal illumination is ample and that illumination on vertical planes over the surface of the street to the height of the tallest vehicle (about 15 ft.) is most important. The illumination on building fronts, again vertical planes, is also of interest but to a lesser degree.

What conditions in street lighting produce high illumination on vertical planes? The color of the object, whether it be light or dark, is, of course, an influencing factor, but one over which there is no control. However, the power of the light source and the incidence of the light flux on the surface to be viewed are of prime importance, influencing the results as expressed by the following formula:

$$\text{Foot-candles} = \frac{\text{candlepower}}{\text{distance}^2} \times \sin\theta$$

This equation gives us the vertical illumination on a plane in definite position with respect to the light source. From this it can be seen that the illumination expressed in foot-candles increases with the candlepower and the value of sin θ. As a vertical plane, such as the back of an automobile, recedes from the light source the value of sin θ increases. If light distribution, such as represented by the dotted curve *M* (Fig. 1) is provided, the product of candlepower and sin θ increases approximately with the square of the distance. Under these conditions the illumination on the vertical plane will be nearly the same at various points between light sources.

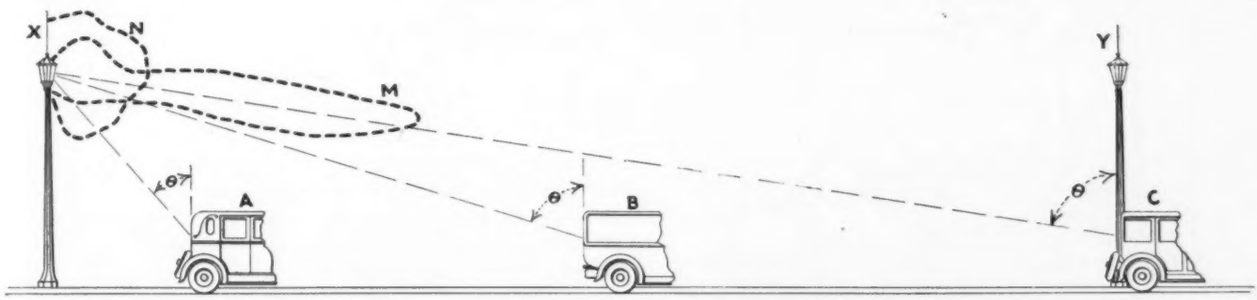


FIG. 1—LIGHT DISTRIBUTION NECESSARY TO SECURE ADEQUATE ILLUMINATION OF VERTICAL PLANES

From the foregoing brief study it is obvious why it is advantageous to control the light from the lamp which would otherwise be distributed as represented by the curve *N*. If a large portion of the light is to meet vertical objects on the street at or near perpendicular incidence, the major output of the lamps must be directed along lines close to the horizontal. Since light so directed has a greater distance to travel before it reaches objects on the street, this is another reason why the energy of the lamp should be concentrated in these directions. Under such conditions it must not be overlooked that a vertical surface coincident with a plane passing through the light source receives no illumination therefrom; therefore its illumination must come from the light source back of it.

So far consideration has been given only to light distribution in the vertical plane without thought of orientation about the vertical axis, generally known as asymmetric distribution. The possibilities in this direction must not be overlooked.

The next question to consider is whether that directional control resulting in asymmetric distribution should be exercised, and if so in what directions and relative amounts. The answer to this must be based on consideration of the relative importance of street lighting as an agency for ornamentation, advertising, convenience, safety and comfort.

Safety being of first importance, a large portion of the total light generated should be applied to the street and sidewalk area on both residential and business streets. Fig. 2A represents a business street having tall buildings on both sides and Fig. 2B represents an asymmetric distribution as seen from above. From Fig. 2B it will be observed that when an automobile driver reaches the area over which the lighting unit has its maximum influence, he cuts the light rays at an angle. This means that the lines of maximum intensity do not coincide with the driver's line of vision, which is a desirable condition, because full glare from the light source cannot be experienced unless the driver looks to one side and upward, which is unnatural. By virtue of the asymmetric distribution of light a forward view is agreeable because of its freedom from glare. Partly on this account and partly because of the increased illumination, vision is improved and eye strain minimized. These conditions tend toward greater safety, comfort and convenience in the use of the street.

Obviously, the character of distribution represented in Fig. 2A is hypothetical, for it shows practically no light admitted in Zones C, E and G. In reality there would be a shading off of intensity in passing from one zone to the next.

If the increased illumination in Zone A, obtained in part by diverting light from Zone C, results in no loss of benefits because of decreased illumination in the latter zone, it is obviously an advantageous arrangement. The effect of employing the light distribution shown in Fig. 2A can be determined by more detailed study. Remembering that this is a main business street, Zone C is occupied by first and second story show windows. The displays in these windows are, as a rule, carefully illuminated and any high lighting intensity from without serves only to interfere with the lighting effects within. This interference may be of three kinds. One is that the superimposed polychromatic light coming through the window tends to wash out the color effects. Another disadvantage of high illumination over the immediate surroundings of show windows is to reduce the effectiveness because of less contrast with the illumination within. The third interference is due to annoying reflections from the window glass when strong light sources are close by. It therefore follows that by decreasing the light in Zone C by diverting it to build up Zone A both zones are benefited.

Over the sidewalk and street areas the utilitarian effect of street lighting is of primary concern. When this purpose is adequately fulfilled without objectionable glares, the results are always desirable, not alone because of the feeling of safety and comfort but also because of the æsthetic effect.

Above the second story of building fronts illumination has little utilitarian worth but may be of decorative value. Although it is desirable to decrease the light intensity in Zones C and G, it may be desirable to increase the intensity above these zones for a certain

FIG. 2, A AND B—SUGGESTED LIGHT DISTRIBUTION FOR MAIN BUSINESS STREET

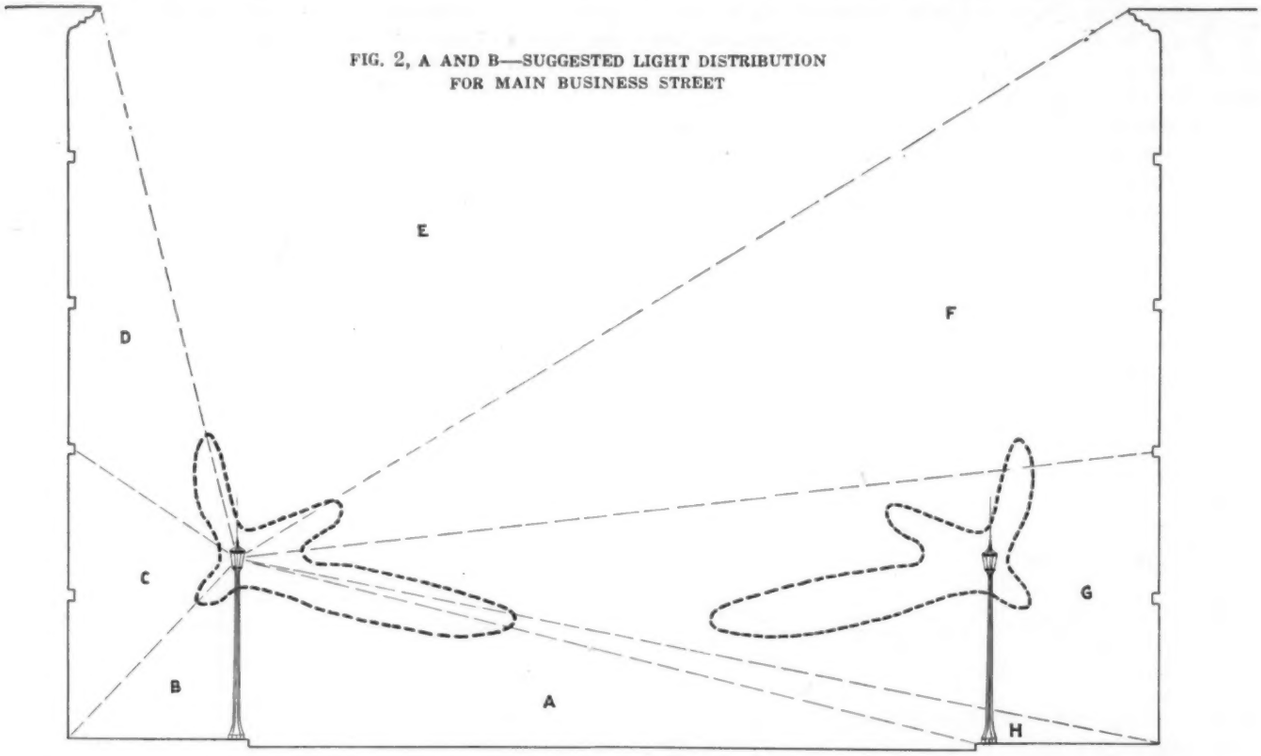
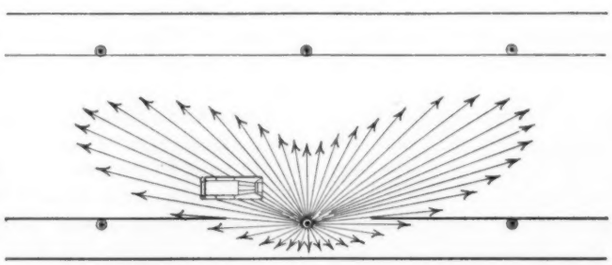


Fig. 2A above—Fig. 2B below



range to reveal the architectural quality of the buildings. Since the distance from the lighting unit to the upper stories is greater than to the third and fourth stories, the candlepower should be graduated approximately as indicated in Fig. 2A. Such a distribution will produce a desirable uniformity in the illumination. Uncontrolled light distribution would produce very high illumination in the immediate vicinity of the lighting unit, and points midway between units would seem considerably less illuminated in contrast with the highly illuminated area. This leads to the consideration of contrast as it affects glare.

It is generally known that with a given light source and a dark background, glare is more severe than in the case of the same source with a well-illuminated background. The first impulse might be to conclude that a highly illuminated area on the building front in the immediate vicinity of a lighting unit would serve as a background for the light in modulating glare. Further consideration would reveal that the area immediately opposite the lighting unit serves as a background only when the unit is viewed from points in the street straight out from the unit or nearly so, whereas over the greater portion of the street the extensive area between units serves as a background. It therefore follows that adequate illumination of midway points is quite as beneficial in reducing glare as it is otherwise desirable. Little light need be emitted into Zone E, the sky area.

When the aim is to illuminate an area that is divisible into rectangles of width but slightly greater than their length, good results may be obtained by applying a lighting source having symmetrical distribution to each subdivision of the area. However, in street lighting the smallest practical subdivision of the area is a rectangle of length equal to the spacing between units and a width equal to one-half the width of the street. Obviously, the length is nearly always several times the width and any symmetrical distribution of the required power properly to illuminate the area throughout its length would necessarily produce the same illumination over extensive areas on both sides of the street. The natural conclusion is that asymmetric distribution is altogether advantageous.

Brush Friction Greatly Affected by Contact Air Pressure

By W. E. Stine
Associate Material Engineer U. S. Navy Yard, New York

EXAMINATION of some data that were taken during tests to determine the coefficient of friction of several grades of brushes has disclosed results that are not only inconsistent with the general laws of physics* but that do not appear to warrant any general conclutions. Attempting to explain these inconsistencies, an investigation was made of the air pressure developed under the brushes and its effect on the total brush pressure and consequently the brush friction. Surprisingly, air pressures were found that far exceeded expectations. Methods of measuring the air pressure under the brushes are indicated in the accompanying illustrations.

It was found that the brush contact pressure on commutators or collector rings, while in operation, is greatly affected by the air pressure developed under them, so that it is very evident that accumulated air pressure must be taken into consideration in accurately determining the coefficient of friction of different grades of brushes. Its importance is shown by the coefficient-of-friction curves in Fig. 2, which data were taken during the tests of one pair of brushes when no attention was paid to the air pressure under the brushes. In general, it was observed that when the air pressure under a brush is less than atmospheric, the pressure decreases with increase in speed, and that when the air pressure under the brush is greater than atmospheric, the pressure increases with increase in speed.

In view of the fact that it is practically impossible to measure the air pressure under all portions of a brush, it has been found advisable, for accurate determination of the coefficient of friction, to arrange the apparatus so that the air pressure under the brushes is nearly equal to atmospheric pressure and to operate the brushes practically radially. In these tests

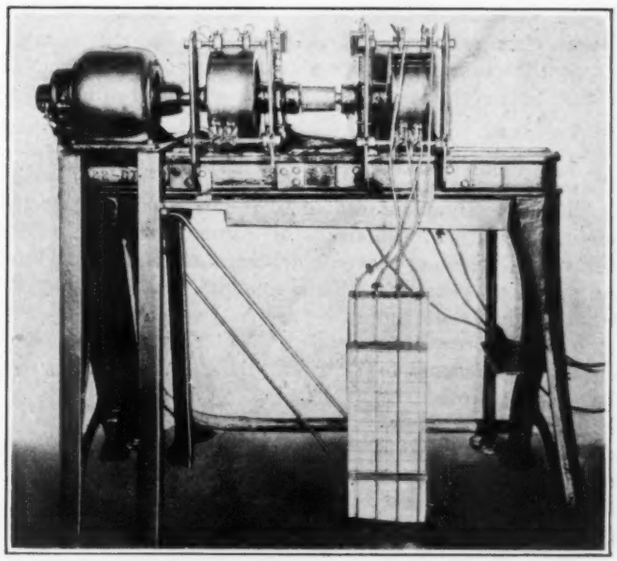


FIG. 1—WIDELY DIFFERENT AIR PRESSURES OBSERVED UNDER FOUR BRUSHES TESTED SIMULTANEOUSLY

Water columns show air pressure under four sets of brushes which had been ground in carefully for 100 hours on a copper cylinder grooved to simulate an undercut commutator. Under one brush the pressure is considerably more than atmospheric; under another considerably less than atmospheric; and under the other two nearly atmospheric. Four "U" tubes are employed that meet in a relatively common reservoir at the back of the board, so that the U-tubes can be arranged to have a common fixed zero or atmospheric line and read on a common fixed scale.

*According to one of the general laws of physics, the coefficient of friction between two solid bodies is independent of contact area, speed and pressure, providing the pressure is less than that required to cut or change the form of the sliding surfaces.

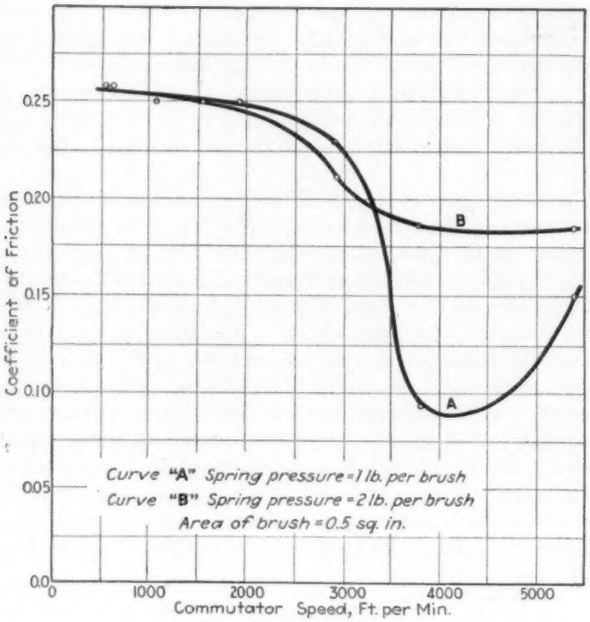


FIG. 2—VARIATIONS IN BRUSH FRICTION WITH DIFFERENT SPRING PRESSURES (AIR PRESSURE UNDER BRUSHES NEGLECTED)

The great variation in apparent coefficient of friction at light spring pressure was probably due to the fact that the difference in air pressure, which varies with speed, was a greater percentage of the spring pressure than with the heavier spring pressure.

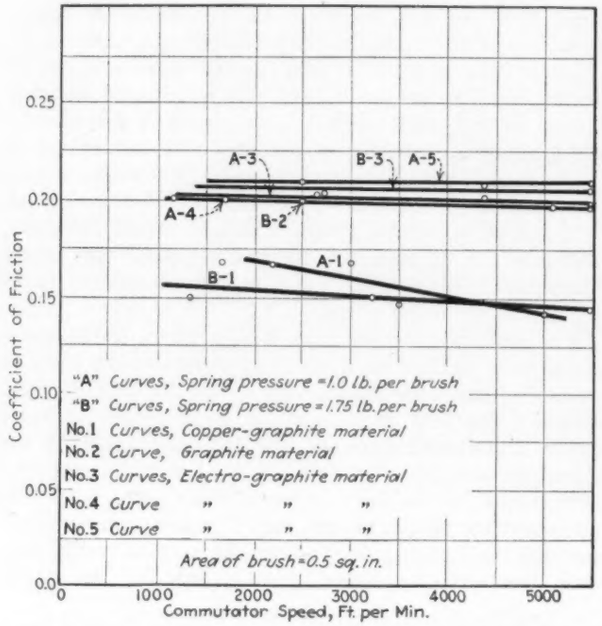


FIG. 3—BRUSH FRICTION WITH DIFFERENT MATERIALS WHEN CONTACT AIR PRESSURE IS MAINTAINED NEAR ATMOSPHERIC

The slight slope which is to be noted in some of the curves is probably due to the fact that it was impossible to bring the air pressure under the brushes to a value equal to atmospheric at all speeds.

the brushes were set at a 5-deg. angle trailing. The effect of brush angle on the air pressure under the brush was not investigated. Sufficient data have not been obtained on collector rings and flush-mica (smooth) commutators to warrant any general conclusions as to the tendency of air pressure under the brushes.

FRICTION INDEPENDENT OF SPEED OR PRESSURE

This investigation seemed to indicate that the coefficient of friction of brushes on commutators or collector rings, when accurately determined, is independent of speed or pressure. This conclusion is contrary to what seems to be the present prevailing opinion, but seems to be substantiated by Fig. 3, which shows coefficient-of-friction curves plotted from data taken during tests of several sets of brushes, the air pressure under which was brought nearly to atmospheric pressure before the readings were taken. These curves cover different grades of brush material.

Although it was previously stated that sufficient data had not been obtained on smooth commutators to warrant any general conclusions, it might be pointed out that in the early stages of the investigation a partial vacuum was developed under brushes running on a smooth copper cylinder, the vacuum varying with the speed. At a speed of 3,000 ft. per minute, an 18-in. (water) vacuum was developed, which added approximately ¾ lb. per square inch of contact surface to the contact pressure produced by the brush-holder spring.

In tests with a slotted cylinder (stimulating an undercut commutator) and with "worn in" brushes, the air pressure under the brushes was atmospheric. Further investigation indicated that when there is no brush chattering or vibration on undercut commutators, the air pressure under the brushes will eventually equal atmospheric.

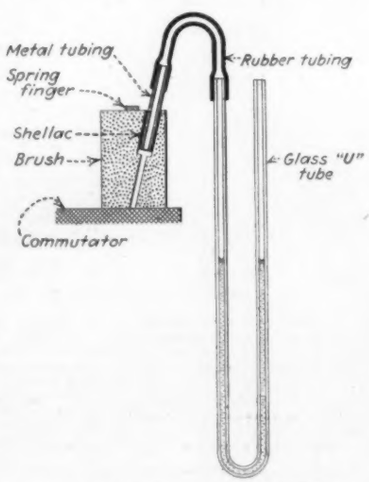


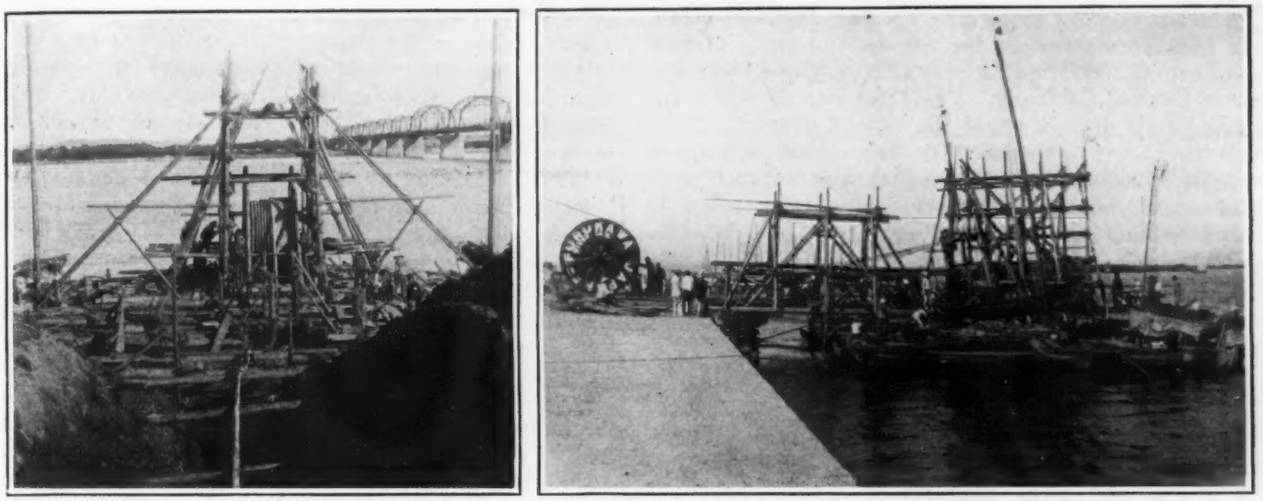
FIG. 4—METHOD OF MEASURING ACCUMULATED AIR PRESSURE UNDER BRUSHES

Water, colored with a small amount of red dye, was used to make the water column easily visible.

LOW FRICTION AT CHATTERING SPEEDS

In obtaining the data from which Fig. 2 was plotted it was observed that at speeds producing appreciable vibration and chattering of the brushes the apparent coefficient of friction was low. The great variation in the apparent coefficient of friction at light spring pressures was probably due to the fact that the difference in air pressure, which varies with speed, was a greater percentage of the spring pressure than was the case with the heavier spring pressure. Chattering or vibration of the brush causes the air pressure under the brush to increase, and the flow of current across the contact causes a further increase in the pressure on the brush.

In general, when a brush tends to ride on its leading edge, the air pressures under the brush will be less than atmospheric, and when the brush tends to ride on its trailing edge, the air pressure becomes greater than atmospheric.



AT LEFT, SHORE END OF CABLE READY FOR LOADING ON JUNKS. AT RIGHT, LOADING THE REEL ON THE RAFT OF JUNKS BY USE OF WOODEN BRIDGE

Record of Cable Laying in Japan

International Power Cable Joining China and Korea Is Successfully Laid Across the Yalu by South Manchurian Railway

BY K. TAKAHASHI
Electrical Engineer Furukawa Electric Company

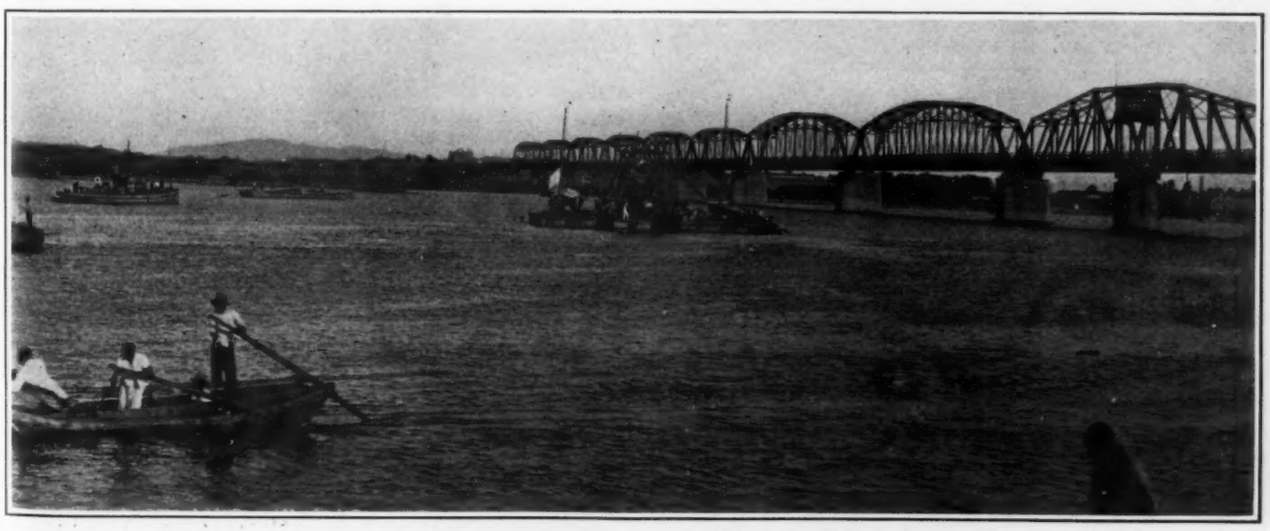
THE submarine power cable laying across the Yalu was recently accomplished by the South Manchurian Railway Company with very satisfactory results. The cable, of a total length of 1,150 meters, was manufactured by the Yokohama Electric Wire Works of the Furukawa Electric Company, Tokio, in two lengths of 750 meters and 400 meters, the first being wound on an iron drum 11 ft. in height and 5.7 ft. in width and weighing 25 tons gross, and the latter on a wooden drum and weighing 15.5 tons gross.

It is a three-core, 11,000-volt, paper-insulated cable, each core equal in area to No. 4/0 B. & S. wire, with three pairs of telephone wires, No. 16 B. & S., inserted in the interstices between the cores, the whole being double sheathed with lead and double armored with sector-shaped steel wires and No. 4 B.w.g. steel wires, the over-all diameter of the cable measuring 3.7 in.

The part of the Yalu where this cable was laid is several score meters above the railway bridge spanning this river, which forms the boundary between Korea and China. The preparations for laying were started on June 2 and finished on July 10, 1925. The difficulty of finding in this neighborhood a vessel that could withstand the strain demanded of a cable-laying boat was overcome by the expedient of joining two junks to serve as the main craft, with one more junk attached on each side to add stability.

The work of laying the submerged portion of the cable, 750 meters in length, was completed in about seventeen minutes in perfect order. The joint-box used in connecting the two lengths is of special construction, designed to give it the tensile and other mechanical strengths equal to those of the armoring. The jointing operation was conducted on board the junks, which were steadied by means of anchors dropped in four different directions. The joining was commenced at 6 a.m. and finished by 10 a.m. the following day and the next day the cable was submerged.

This cable is used for transmitting power across the Yalu from the power station at Antoken (An-tung-hsien) to Shin Gi-shu (Shin Yi-chow) on the South Manchurian Railway line, and is therefore international.



IN MIDSTREAM WHILE LAYING THE CABLE

The entire work of installation was conducted under the joint supervision of the engineering staffs of both the South Manchurian Railway Company and the Furukawa Electric Company. The cable joining was made by the gang of jointers of the latter company. There was in this neighborhood no mechanical equipment capable of utilization in laying a cable of such huge dimensions, hence considerable pains were taken to carry out the work in perfect order.

Letters from Our Readers

Power Factor and Production Cost

To the Editor of the ELECTRICAL WORLD:

A number of interesting studies have been made in recent years of the important subject of power-factor correction, and many illuminating articles have appeared in the periodicals. Much of this material is of a highly technical character, whereas the industry has needed a broad view of the subject which recognizes the interests of both the supplying utility and its power customers. Such a treatment is found in the paper on "Power Factor and Production Cost," by R. C. Muir, in the May 15 issue of the ELECTRICAL WORLD. This paper is deserving of careful reading and re-reading by operators who have power-factor problems pressing for solution.

Mr. Muir points out that the power-factor item is an insignificant part of the cost of the manufacturer's product. The cost of power in the average factory is materially less than 5 per cent of the value of the product, and the added cost of low power factor is a similarly small percentage of the power bill. Aside from his problems of personnel, which are of particular importance, the manufacturer is primarily interested in simplicity and reliability in his production facilities, all leading to sustained and efficient quantity production of the article manufactured.

On the other hand, power companies whose sole business is selling electric service find that low power factor adds largely to their investment and appreciably to their operating cost. Various attempts have been made in rate schedules to effect an automatic improvement of power factor. The majority of these attempts have stopped with a penalty for low power factor and have lacked any constructive incentive for high power factor. Such measures are often resented by the customer and result only in raising power factor enough to avoid penalties rather than in carrying the improvement to the further point of maximum economy. In those rate schedules which have embodied both bonus and penalty provisions the basis of rate correction has commonly lacked close adjustment to the benefits derived. Mr. Muir particularly points out that care should be exercised in rate making not to allow more for improved power factor than it is really worth to the company nor to charge more for low power factor than the cost of its correction by the customer.

The advantages of unit drive, the greater simplicity of induction motors and their lower cost in small sizes all indicate the advisability from the manufacturer's point of view of the continued use of this form rather than the synchronous or other complicated types, although where large synchronous motors can be used they have definite advantages. It follows that in many cases low power factor must be corrected rather than avoided.

Assuming that correction is necessary, its type and point of application must be determined. Mr. Muir suggests that synchronous condensers or capacitors at distributing substations may be most economical because the corrective units may be in large and relatively low-cost sizes, and the major saving in investment through high power factor is on the generating side of these substations. There still remains the problem of correcting the distribution system and also the customer's own wiring, which certain studies have shown may advantageously be included in the analysis.

Up to the present time power-factor correction on the customer's premises has been limited largely to synchronous motors. Capacitors have been used to a limited extent, but their behavior has not always been satisfactory and their cost has been discouragingly high. The simplicity of this latter type of correction equipment suggests the advisability of further research regarding its usefulness and the possibilities of quantity production which will permit such lower prices that power-factor correction can be economically made at the point of power application rather than nearer the sources of power, where full correction is impossible.

The layman is inclined to wonder why small motors could not be equipped with capacities in their bases without adding seriously to their bulk or cost. In the not distant future millions of fractional-horsepower motors will be required for domestic refrigeration alone. These motors, with their relatively large air gaps and high magnetizing current, necessarily have a low power factor but operate under a practically constant load, so that close power-factor correction would appear possible. Other power applications might have similar treatment, the advantage of the attached rather than a detached corrective capacity from the power-supply point of view being a more extended, unquestioned use.

More careful engineering studies may show that correction may more economically be applied elsewhere and that it can be best supplied by the power companies rather than their customers. If so, rate schedules should be so revised that the cost of low power factor, whatever it may be, falls upon those customers that create it, with, however, automatic provision for such correction by the customer as the character of this production justifies. Various studies have clearly indicated that low power factor should not continue uncorrected, and that its cost, when assessed upon large power users, may be much greater than the additional cost of alternative synchronous-motor operation. For small power service the extent to which the customer rather than the company should undertake correction is not yet clear. Our power salesmen are continually advocating purchased power because of the relatively low investment and operating cost of the large generating equipment operated by the power companies and the customer's freedom from operating complications. This argument may properly be applied in many cases to the power-factor item.

The industry as a whole has not given this subject the attention which it deserves, and it is quite time that a comprehensive survey were made of its technical, commercial and economic phases so that a rational basis of procedure may be established. L. R. NASH,

Vice-President Operating Division, Stone & Webster, Inc.
Boston, Mass.

Central Station and Industrial Practice

Pole Preservation Permits More Economical Utilization of Timber

THERE is an important opportunity for economy that has received altogether too little attention, according to Kurt C. Barth, director, research division, Western Red Cedar Association, speaking before the Electric Lines Club at Lynn, Mass., recently—namely, the opportunity for more accurate design and greater saving in the selection of pole sizes where treated poles are employed.

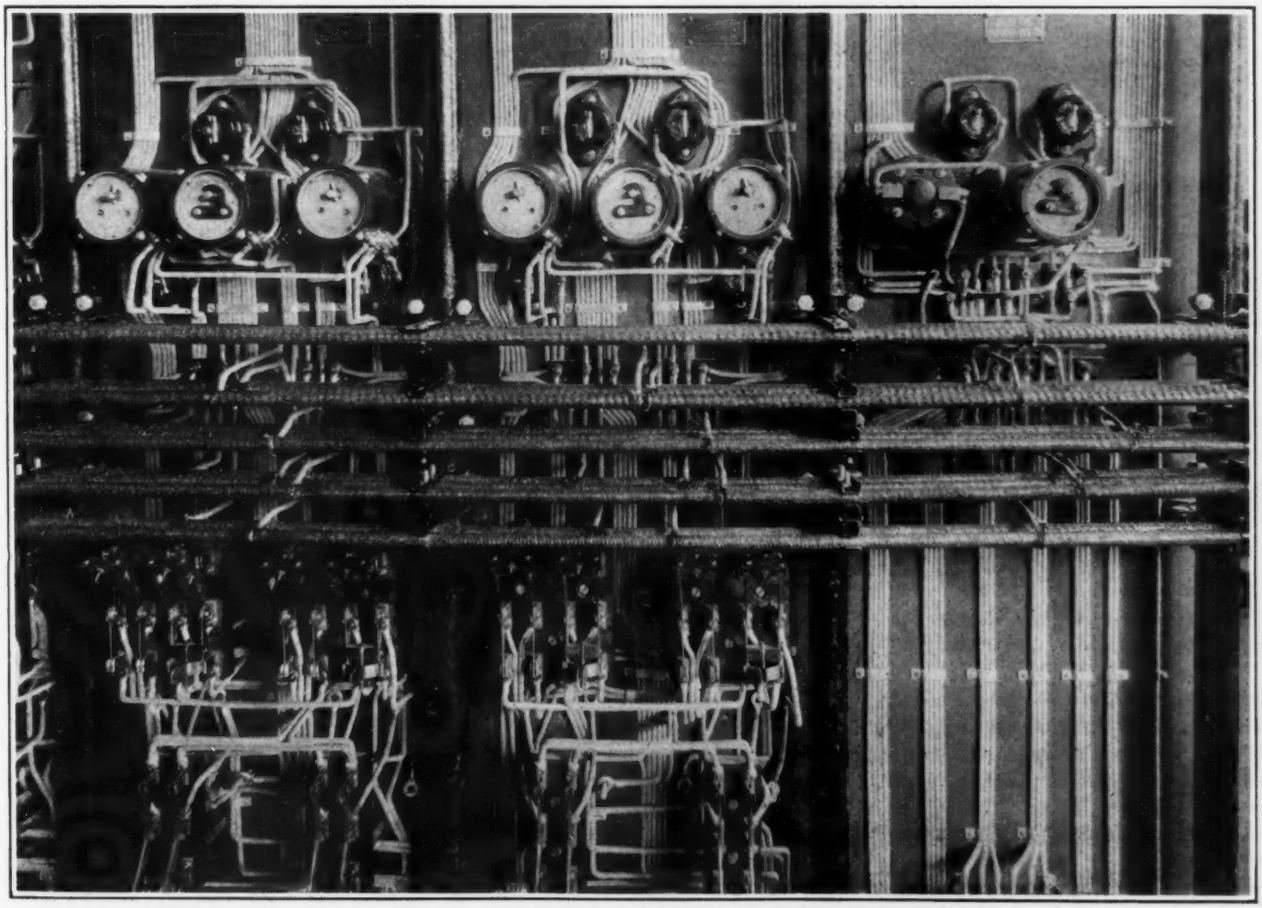
Data gathered on California experimental poles show that replacement of untreated poles would have been required for Grade C construction under the National Electrical Safety Code rules after eight years' service, whereas the treated poles depreciated only 2 per cent in strength after sixteen years of service.

Untreated Pole:	
Factor of safety	4
Initial assumed M. (pound-feet)	120,000
Size pole required Class A 40 ft. W. R. C. Circumference 6 ft. from butt 45 in.	
Resisting moment (pound-feet)	134,617
Replacement when depreciated, per cent (factor of safety, 2)	50
Years of service to be expected	18
Treated Pole:	
Substituting Class C-40 ft. W. R. C. Circumference 6 ft. from butt 34 in.	
Resisting moment (pound-feet)	58,063
Initial factor of safety developed	1.94
Replacement at factor of safety of	1
Years of service to be expected	27
Saving in annual cost, per cent	31.5
Saving in volume of timber, per cent	22.9

If it were assumed that the poles reported removed (2.1 per cent) on account of decay between eleven and sixteen years had been replaced after eleven years' service; that the poles reported as affected by decay (22.5 per cent) were replaced after sixteen years' service; that the remainder (75.4 per cent) reported as sound ceased to derive further protection from the preservative treatment and had begun to depreciate at the average rate of untreated poles, then an average life for treated Western red cedar poles of 21.7 years would be established. Or if the data were applied to the country as a whole, the average life of treated cedar poles would be 26.5 years. After 25 years' service the maximum depreciation of the strength of the treated poles would be 50 per cent, requiring a maximum safety factor for new construction of 2, irrespective of the grade or character of the location at which the pole is to be used.

In other words, where an initial safety factor of 4 and a replacement factor of 2 are required, and

Protection of Small Buses



CIRCULAR LOOM, USED AS INSULATION FOR BUSES OF COPPER TUBING, IS EASILY INSTALLED AND HAS VERY PRACTICAL VIRTUES

the type of contruction demands a Class A 40-ft. untreated pole, a Class B 40-ft. treated pole could be used. Better still, the same load could be carried safely on a Class C 40-ft. treated pole, with an initial safety factor of 2 and replacement when depreciated 50 per cent. This pole would serve about 27 years at a saving in annual cost of 31½ per cent and in volume of timber 23 per cent. The example given in the table on page 71, based on an assumed load of 30,000 lb.-ft., illustrates this.

Simplification of Line Calculations

Extended Mershon Chart Used to Arrive at Power Loss Values—Methods for Short-Cutting Calculations

BY CHARLES MORRISON
Potomac Edison Company, Hagerstown, Md.

TRANSMISSION line calculations may be readily made by use of a chart similar to the one reproduced here. This is nothing more than the familiar Mershon diagram extended down to zero power factor and with the lower half added for leading power factors.

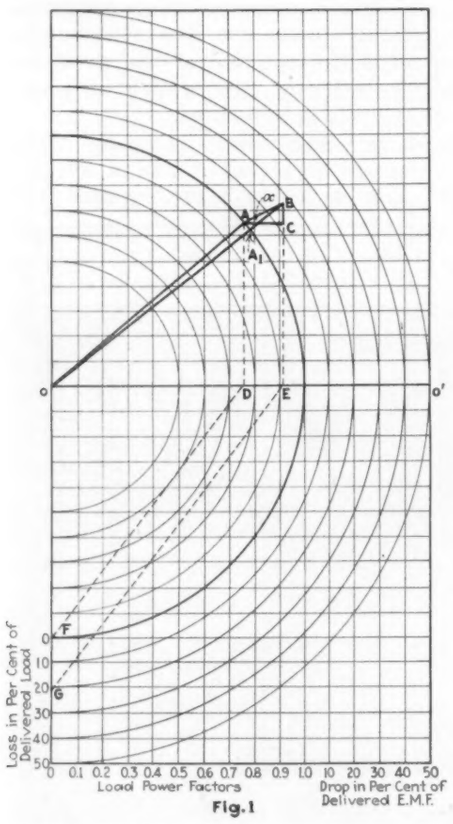


Fig. 1

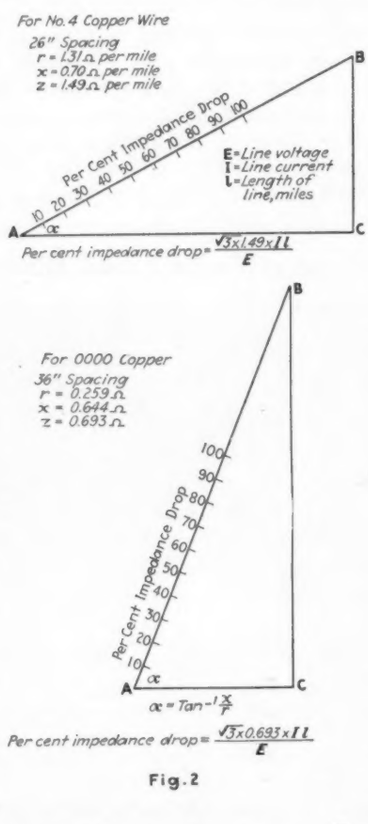

For No. 4 Copper Wire
26" Spacing
r = 1.31Ω per mile
x = 0.70Ω per mile
z = 1.49Ω per mile
Per Cent Impedance Drop
E = Line voltage
I = Line current
l = Length of line, miles
Per cent impedance drop = √3 x 1.49 x I l / E
For 0000 Copper
36" Spacing
r = 0.259Ω
x = 0.644Ω
z = 0.693Ω
Per Cent Impedance Drop
α = Tan⁻¹ x/r
Per cent impedance drop = √3 x 0.693 x I l / E

Fig. 2

AT LEFT, MERSHON CHART EXTENDED TO POWER LOSS COMPUTATION. AT RIGHT, $\frac{x}{r}$ TRIANGLES TO FACILITATE CALCULATIONS

The usual method of finding the voltage drop may be carried out and will be briefly described here. First calculate the resistance drop and the reactance drop in per cent of the delivered voltage. Then from a point on the power factor scale corresponding to the power factor of the delivered load draw a vertical line, upward for lagging power factors and downward for leading power factors. From the point where this vertical line cuts the circle marked "1.0" lay off horizontally the per cent resistance drop, and from the end of this horizontal line lay off vertically the per cent reactance drop. The voltage drop in the line is then given by the number of the circle passing through the end of the vertical line representing the reactance drop.

The power loss may be determined from the chart as follows: Extend the line representing reactance drop back to the power factor scale, as shown by line *CE*. From the point representing the power factor of the load draw a straight line to the zero point of the power loss scale, as shown by *DF*. Then parallel to *DF* draw a straight line through point *E*, and where this line cuts the power loss scale read the per cent of delivered power lost on the line.

This method may be proved correct, as follows:

In a three-phase line the power loss is expressed by the formula $P_1 = 3I^2R$, where P_1 represents the power loss, I the line current, R the total resistance of each wire.

The delivered power is represented by the relation $P = \sqrt{3}EI \cos \theta$, where P represents the delivered power, E the line voltage, $\cos \theta$ the power factor of the load.

The per cent power loss is then

$$\frac{P_1}{P} \times 100 = \frac{3I^2 R \times 100}{\sqrt{3}EI \cos \theta} = \frac{\sqrt{3}IR}{E \cos \theta} \times 100 = \frac{\text{Line resistance drop}}{\text{In phase component of delivered voltage}} \times 100.$$

On the chart this ratio is represented by $DE \div OD$.

Since $DE \div OD = FG \div OF$, FG represents the power loss in per cent of delivered power.

The following example is worked by means of the chart in order to make its use clear:

Line constants:
- Length, 20 miles.
- No. 4 copper wire, spaced 26 in.
- Resistance, 1.31 ohms per mile.
- Reactance, 0.70 ohm per mile.

Load:
- Kilowatts, 5,000.
- Power factor, 75 per cent.
- Voltage, 33 kv.
- Frequency, 60 cycles.
- Three-phase balanced load, wires symmetrically spaced.

The line current then equals 116.5 amp.

The line resistance drop then equals 3.06 kv. per wire, or 16 per cent of the delivered voltage.

The line reactance drop then equals 1.635 kv. per wire, or 8.5 per cent of the delivered voltage.

On the illustration at the point representing 75 per cent power factor erect the vertical line *DA*, which cuts circle "1.0" at *A*. From *A* lay off horizontally *AC*, which represents the 16 per cent resistance drop. From *C* lay off vertically *CB*, which represents the 8.5 per cent reactance drop. Point *B* lies on the 17.5 per cent circle, hence the voltage drop on the line is 17.5 per cent.

Now draw *OB*. Where this line cuts the circle marked "1.0" read the power factor at the transmitting end of the line, which in this example is 78 per cent.

Project *BC* back to the power factor scale. Draw the line *DF* and parallel to this a line through the point *E*.

Where this line cuts the power loss scale read 21.5 per cent power loss.

For an actual working chart it is convenient to use fine quadrille ruled paper. Each small division may be made to equal 1 per cent, instead of 10 per cent, as on the sample chart shown.

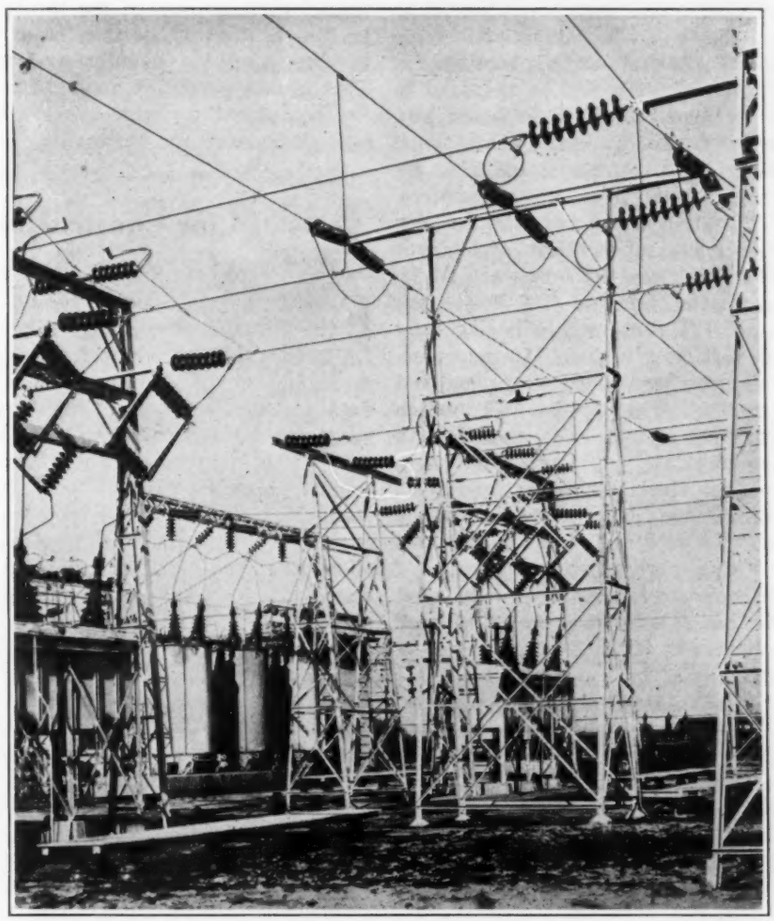
For convenience in working out a series of calculations on the same line or on the same type of line, triangles may be ruled as shown, and cut out of heavy drawing paper. The scale for the per cent impedance drop will of necessity be the same as the scale used on the chart. The angle α of each triangle will depend on the size wire and the spacing, and numerically it will be the angle whose tangent $= \frac{x}{r}$ for the wire in question.

To illustrate the use of the triangles consider the example worked out above. Find point *A* on the chart as explained above. Then take the triangle for No. 4 wire with 26-in. spacing, and lay the edge *AC* parallel with *OO'* on the chart, with the point of the angle α exactly on point *A* of the chart. Now find the impedance drop for the load and line by means of the formula given on the triangle, which in this case will work out to be 18.3 per cent. Lay this value off on the impedance drop scale on the triangle, and corresponding to this point on the chart will be located point *B*, which lies on the 17.5 per cent circle. The rest of the example is then worked as above. The particular value of the triangles lies in cases where the voltage drop and power loss is desired for different loads and power factors on the same line, as it is then necessary only to move the triangle about over the chart instead of working out the resistance and reactance drop separately for each load.

High-Tension Buses Suspended on Individual Steel Structures

BY H. S. MINOR
Superintendent Substation Construction, San Joaquin Light & Power Corporation, Fresno, Cal.

SIX YEARS ago, when the San Joaquin Light & Power Corporation started using steel structures to support substation buses, a type of structure was designed that differs somewhat from the supports usually used for this purpose. Individual dead-end structures are used throughout and all buses are pulled into place and secured by strain insulators. Spans range from 40 ft. to 80 ft. in length, thereby greatly reducing the number of beams or girders and insulated supports necessary. When tubular conductors of large diameter are used, supported on rigid post insulators, spans of not more than 20 ft. are attempted. The use of individual steel towers allows greater clearances between oil switches, transformer banks, etc., than could be secured by the use of one single structure with all beams and columns interconnected.



INDIVIDUAL STEEL BUS STRUCTURES EFFECT SAVINGS IN STEEL AND INSULATORS

The accompanying illustration shows a portion of the 110-kv. buses and structures at the Sanger substation of the San Joaquin Light & Power Corporation. In the left foreground is shown part of one of the 110-kv. oil switch structures, and beyond is one of the two 15,000-kva. auto-transformer banks at this station.

These steel structures have been standardized so that for a 70-kv. substation only three different types of structures are used—an oil switch structure, a dead-end structure for a 19-ft. bus and a transfer bus structure. The oil switch structure is erected directly over the oil switch and allows the use of a switch 18 ft. wide and 12 ft. high. It supports six disconnects, three on each side just above the oil switch, and a bypass air switch may be mounted on the upper beam. This upper beam provides for the support of a 24-ft. bus, and a 19-ft. bus may be taken from a lower beam, which also carries the upper end of the disconnects. This complete structure is used for all 70-kv. oil switch positions, and a modified structure is used to provide future switch locations, the disconnects and supports not being installed. This complete structure weighs 2,600 lb. and is designed to support an unbalanced strain of 1,500 lb. per wire on each of the three wires. A 24-ft. or a 19-ft. bus may be supported from either side or both sides of this structure.

The footings are set in reinforced concrete blocks from 2½ ft. to 3 ft. square and 10 in. thick placed about 5 ft. below the surface. The use of concrete is more economical for these structures than deeper excavations and heavier steel earth anchors such as used on transmission line towers,

as concrete must be used for transformer and oil switch foundations, etc., in any case.

To provide a complete substation layout consisting of two banks of transformers and two 70-kv. line switches, all four oil switches being provided with bypass equipment, eleven of these structures would be required, weighing about 23,000 lb., and 48 five-unit 10-in. porcelain insulator strings would be required to support the buses. This would also provide two additional line locations, which could be made available by adding transformer bus structures.

The structures are similar for 110-kv. substations but are larger and heavier, as the buses are 24 ft. and 33 ft. high and the phases are spaced 9 ft. centers both horizontally and vertically. Eight 10-in. porcelain units are used for dead-end purposes. The 110-kv. oil switch structures provide clearance for an oil switch 24 ft. wide and 15 ft. high. The first steel structures used were painted, but last year galvanized steel was used and it has been found that it is more satisfactory.

If one steel structure were used with buses supported on rigid post insulators at 20 ft. centers, the steel would cost about 50 per cent more and the insulators about three times as much for the same clearances as would the type of construction described. Most of the substations on the San Joaquin system are located in rural districts and the cost of the property does not amount to more than 1 or 2 per cent of the total cost of the installation, so that from one to five acres is usually available. This allows plenty of room to place the equipment on wide centers and still allow room for expansion.

Costs of Line Construction Work at Gardner, Mass.

FROM the construction records of the Gardner, Mass., Electric Light Company, of which C. A. Ware is manager, the accompanying cost data are given for five typical jobs recently analyzed from the labor and material standpoints. The Gardner company serves a city of about 20,000 population and a considerable rural area outlying. As the tabulations show, the field costs of this central station are kept with more than ordinary care.

Table I gives the cost of extending a three-phase, 4,600-volt transmission line of No. 4 copper from the Blanket Mill site in Hubbardston to North Rutland, a distance of three miles. The work was done during the year 1925.

The cost of a replacement job is shown in Table II. On the company's Barre, three-phase, 6,600-volt line, 16.7 miles long, No. 6 B. & S. hard-drawn copper-clad steel wire was replaced in 1924 with No. 4 solid copper. The estimated cost was exceeded by only $290.62 when the field sheets were completed.

To permit the inspection of an oil circuit breaker at the Barre substation, a 400-amp., triple-pole, single-throw knife switch was installed at a cost shown in Table III, as itemized.

The various items entering the cost of constructing a two-pole structure with platform to mount a 15-kw. transformer and make the necessary connections to supply power to two industrial customers in Gardner are shown in Table IV.

Table V shows the cost of erecting a 6-ft. wire fence around the Gardner substation in 1924, the fence being 231 linear feet long, with a 14-ft. gate.

TABLE I

Items	No. of Units	Price	Amount	Total Charges
Labor	....	.....	.....	$2,615.73
Expenses (miscellaneous)	....	.....	.....	111.76
Auto and truck mileage	....	.....	.....	721.46
Materials:				
30-ft. class "B" chestnut poles	2	$6.50	$13.00	
35-ft. class "B" chestnut poles	53	9.55	505.98	
40-ft. class "B" chestnut poles	15	13.55	203.25	
45-ft. class "B" chestnut poles	24	15.28	366.75	
50-ft. class "B" chestnut poles	11	18.72	205.87	
45-ft. cedar poles	3	28.77	86.31	
50-ft. cedar poles	13	30.00	390.00	
No. 4 hand-drawn copper wire	5,898 lb.	Lot	947.11	
No. 4 weatherproof wire	1,165 lb.	Lot	206.44	
½-in. galvanized guy wire	1,540 ft.	Lot	28.00	
6-in. pin crossarms	153	Lot	201.82	
No. 44 Locke insulators	340	Lot	30.37	
Miscellaneous other	131	Lot	24.24	
Locust pins	934	Lot	26.10	
28-in. crossarm braces	312	Lot	38.69	
3-bolt guy clamps	156	Lot	37.49	
S. & C. cutouts	3	14.69	44.08	
No. 270,335 cutout boxes	1	.....	7.26	
6-ft. galvanized anchor rods	35	0.45	15.75	
6-ft. outrigger braces	2	4.29	8.58	
Protexol pole preservative	16.5 gal.	Lot	12.17	
Galvanized guy thimbles	77	Lot	3.82	
No. 4 splicing sleeves	45	0.09	4.05	
Miscellaneous bolts and lag screws	641	Lot	50.10	
Miscellaneous washers	845	Lot	12.66	
Solder, paste and tape	Lot	.....	6.02	3,475.91
Total				$6,924.86

TABLE II

Items	No. of Units	Price	Amount	Total Charges
Labor	....	.....	.....	$2,615.72
Expenses (miscellaneous)	....	.....	.....	184.33
Auto and truck mileage	....	.....	.....	556.28
Materials:				
No. 4 Am. electric bare copper	34,436 lb.	Lot	$5,081.06	
No. 6 solid bare copper	65 lb.	.....	11.05	
No. 1 3-strand bare copper	260 lb.	.....	37.70	
No. 4 splicing sleeves	77	.....	10.18	
No. A-1 seamless splicing sleeves	200	.....	28.50	
V. & P. roller clevises	24	$0.34	8.16	
Three-bolt galvanized guy clamps	12	0.22	2.64	5,179.29
Total				$8,535.62

TABLE III

Items	No. of Units	Price	Amount	Total Charges
Labor	....	.....	.....	$66.93
Expenses (miscellaneous)	....	.....	.....	7.65
Auto and truck mileage	....	.....	.....	18.54
Materials:				
400,000 cm. cable	204 ft.	Lot	$68.21	
400,000 Dossert Lee connectors	9	Lot	22.96	
400-amp. T.P. S.T. barrier type switch	1	.....	44.15	
4-in. conduit elbow	1	.....	7.00	
4-in. A-10 condulet	1	.....	8.55	
4-in. locknut	3	$0.48	1.44	
Porcelain cover, No. 103	1	.....	0.86	
Lag screws and shields	Lot	.....	0.86	154.03
Total				$247.15

TABLE IV

Items	No. of Units	Price	Amount	Total Charges
Labor	....	.....	.....	$82.66
Auto and truck mileage	....	.....	.....	18.19
Materials:				
30-ft. class "B" chestnut poles	3	$8.71	$26.13	
Lumber for platform	Lot	.....	14.24	
No. 4 weatherproof wire	60 lb.	0.198	11.88	
No. 6 weatherproof wire	32 lb.	0.198	6.34	
Six pin crossarms	3	1.55	4.65	
Four pin crossarms	4	1.04	4.16	
½-in. galvanized guy wire	150 ft	0.037	5.55	
Miscellaneous bolts, pins, braces, etc.	Lot	.....	20.77	93.72
Total				$194.57

TABLE V

Items	No. of Units	Price	Amount	Total Charges
Labor	....	.....	.....	$33.98
Auto and truck mileage	....	.....	.....	26.31
Materials:				
231 linear ft. 72 in.	....	.....	.....	508.50
Galvanized chain link, No. 8 wire, twenty mesh, with barbed top and bottom, fencing, with 2½ in. posts and 14 ft. gate	Lot	.....	$492.28	
Pipe and fittings	....	.....	12.42	
Freight	....	.....	3.80	
Total				$568.79

Commercial Activities and Public Relations

Appliance Demonstrator Complete in Details

IMMEDIATELY facing every person entering the new electric shop of the Nebraska Power Company, Omaha, is an automatic customer-appliance demonstrator which is unusually complete in performing the functions it is intended to serve. It moved about from one outlet to the next by a motor. This motor also operates a window-type semaphore indicating the device in operation and actuates a contactor connecting the device in operation with the meter above.

The meter is labeled: "This Meter Indicates the Cost per Hour." The semaphore indicates the device in

AN EFFECTIVE APPLIANCE DEMONSTRATOR USED BY THE NEBRASKA POWER COMPANY

is shown in an accompanying illustration.

Seven electric appliances that should be used in every home—an iron, percolator, toaster, vacuum cleaner, table lamp, grill and electric cooker—are displayed on a table situated as previously mentioned. Just back of the table is a vertical panel, at the top of which is a watt-meter calibrated in "cents per hour." Near the bottom of the panel, arranged in a circle, are seven convenience outlets, to which the appliances displayed are connected. In the center of this circle of outlets is a pointer, which is periodically operation, what it will accomplish in one hour and the cost of energy per hour. In connection with the last item, reference is made, each time, to the meter above.

Thus the display is situated where it will attract attention, produces action to retain attention, actually operates the device and gives the information an observer wants—namely, what it will do and what it will cost.

K. P. Goewey is sales and new-business manager of the Nebraska Power Company, which has been unusually active in merchandising electric appliances for several years.

Effect of Electric Appliances on Physical Labor

RESULTS of tests recently made in various parts of Indiana show interesting comparisons between household labor on the farm before and after installing electric appliances, according to Dr. G. I. Christie, Purdue University. Three examples follow:

Ironing.—Pedometer showed one woman walked at rate of thirteen miles a year between ironing board and range (separated only 5 ft.) before electric iron was used.

Washing. — Time consumed in weekly laundry work reduced from six to three and one-half hours in one case by substituting 1 kw.-hr. of electricity for drudgery of hand labor.

Lighting. — Cleaning and filling kerosene lamps on one farm required one full year of twelve-hour days during a period of 40 years.

Guaranteeing Satisfaction Aids Heating Sales

BY J. L. FARLEY
Industrial Heating Specialist, Pacific Gas & Electric Company, San Francisco, Cal.

A LITTLE less than a year ago the Pacific Gas & Electric Company set up a fund of several thousand dollars with which to guarantee the wiring contractor and in some cases the jobber and manufacturer, too, against loss in cases where industrial heating installations did not prove satisfactory. The primary purpose of the plan was to stimulate industrial heating installations by showing the prospective user that the central station was so certain of the advantages and economy of electric heat that it was willing to back up the installation with a guarantee of satisfaction to the purchaser.

The surprising thing about the plan is that it had the psychological effect upon the customer of removing any doubt he may have had concerning the advantages of industrial heating. The fact that only six customers availed themselves of this guaranty during the first nine months indicates that the idea of

electric heat in industrial processes has been quite effectively sold. Under the plan the manufacturer usually stands back of the jobber on the equipment and the power company protects the wireman against loss if the installation has to be removed. So far under this plan, however, not a single installation has proved unsatisfactory and no losses have been sustained by any of the parties concerned.

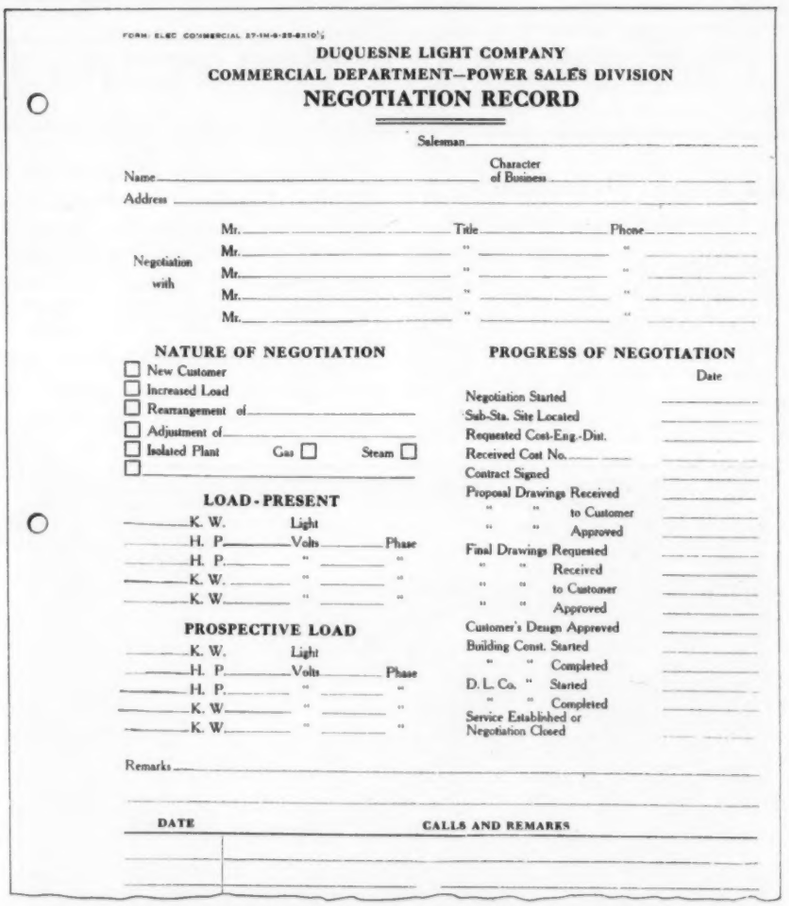
Such a plan for selling industrial heating, aside from constituting the finest kind of sales argument, has the advantage that it provides a means of pioneering in a new field where special equipment is necessary and the customer is unwilling to take a chance. The Pacific Gas & Electric Company has had the greatest success, however, by concentrating its sales activities on those processes for which standard equipment is now on the market.

A Complete and Simple Prospect Record

MANY systems for maintaining prospect lists defeat their purpose because they are too elaborate or entail a burdensome amount of clerical work. These objections have been overcome by a comparatively simple method of recording negotiations with prospective power customers which is used by the power sales division of the Duquesne Light Company in Pittsburgh. The accompanying illustration shows the form of negotiation record or prospect sheet that is used.

It will be noted that space is provided on the face of the record for entering all the essential information regarding an industrial plant with which negotiations are being conducted. Name and character of the business, kind and extent of load, present and prospective, are given, as well as space for noting the progress of the negotiations from start to finish. At the bottom of the sheet and on the reverse side the sales engineer enters the date and remarks of each call he makes on the prospect.

The method of keeping track of the progress of negotiations is extremely simple. Each sales engineer has a ring folder with an alphabetical index. In this he keeps negotiation record sheets for every prospect which he is working, with latest developments entered under the calls and remarks column. The folder



DUQUESNE LIGHT COMPANY
COMMERCIAL DEPARTMENT—POWER SALES DIVISION
NEGOTIATION RECORD

Salesman
Name — Character of Business
Address
Negotiation with: Mr. / Title / Phone
NATURE OF NEGOTIATION
New Customer
Increased Load
Rearrangement of
Adjustment of
Isolated Plant Gas Steam
LOAD - PRESENT
K. W. Light
H. P. Volts Phase
PROSPECTIVE LOAD
K. W. Light
H. P. Volts Phase
PROGRESS OF NEGOTIATION
Date
Negotiation Started
Sub-Sta. Site Located
Requested Cost-Eng.-Dist.
Received Cost No.
Contract Signed
Proposal Drawings Received
" " to Customer
" " Approved
Final Drawings Requested
" " Received
" " to Customer
" " Approved
Customer's Design Approved
Building Const. Started
" " Completed
D. L. Co. " Started
" " Completed
Service Established or Negotiation Closed
Remarks
DATE CALLS AND REMARKS

RECORD OF NEGOTIATIONS WITH PROSPECTIVE CUSTOMERS

containing these sheets remains on the salesman's desk at all times. In addition to this there is one master folder in which is kept a duplicate of all the sheets contained in the salesman's folder but filled out only as far as the name of the prospect and nature of the negotiation are concerned.

By this means it is possible, by using the master folder, for anyone to locate which sales engineer is handling a particular case and then by reference to that sheet in his folder to determine the existing status of the negotiations with any prospect. In practice this method has been found to entail less work and at the same time supply more adequate up-to-date information than any system so far used to keep track of prospective customers.

Possibilities of Silo Filling with an Electric Motor

BY HOWARD C. FULLER

IN CONNECTION with the general problem of rural electrification, the Utica Gas & Electric Company, Utica, N. Y., carried on a silo-filling experiment. The problem was attacked more from the agricultural than from the technical standpoint inasmuch as it is thought that the necessary improvement must come from this field. The objects of the test were to get a comparison between a motor and a tractor job as to convenience, speed etc.; to secure information which would be of value in designing future outfits, and to determine the best method of handling the work of silo filling and the factors entering into the job.

No change was made in the usual equipment used for silo filling. The tractor and the motor were placed as usual and the engineer in charge of the test acted as an observer. The motor circuit included a watt-hour meter and a recording watt-meter.

In the case of both outfits, the cutter was not operated at anywhere

near its rated capacity. It is apparent that a smaller cutter could have handled just as much corn and with a correspondingly lower power consumption. An ordinary land tractor of 12/20-hp. rating was used. The motor was a 20-hp., three-phase outfit mounted on the truck.

The recording wattmeter chart shows some very interesting things in regard to this test. It was noted that there was a characteristic about the way each man threw off his load, which could be traced on the chart.

A chart made immediately after a new set of knives had been put into the machine showed less power consumption with no high peaks. The chart for a demonstration load run through by the farm manager and the engineer in charge of the test indicated no high peaks due to "stuffing" the machine and there was an even distribution of load throughout the whole run.

The energy consumption, the men and teams working and the number of loads were recorded each hour. From a study of these details the following conclusions may be drawn:

1. The organization does not get under way immediately and there is, therefore, a low production during the first hour.

2. The energy consumption increases as the result of load increase.

3. The energy consumption per load is decreased when the rate of feeding the machine is increased, but machine was never overloaded.

4. The total cost per load is less when the rate of feeding is high.

PERFORMANCE DATA OF TRACTOR AND OF MOTOR ON SILO FILLING

	Tractor	Motor
Total running hours	21.24	14
Total number of loads	81	91
Total tons of silage	130	154
Loads per hour, average	3.82	6.5
Tons per hour, average	6.12	12.14
Total man-hours	194.5	154
Total team-hours	63.1	56
Fuel cost per ton	$0.07	
Energy cost per ton		$0.05
Kilowatt-hours per load		1.
Total cost per ton	$0.904	$0.58
Saving per ton		$0.324

A table supplies a summary of the experiment. The savings with the use of the electric motor were believed to be due to somewhat better weather, cheaper energy, less lost time in starting and attending to the motor, operating the motor only when there was corn to be cut and a less tendency on the part of the motor to slow down when the load was momentarily heavy.

Rent and depreciation on investment were not charged, as these are difficult, variable things to figure.

The advantages of the motor drive are summarized: The outfit can be built in small sizes and used on individual farms or small groups of farms, and thereby save considerable feeding value due to getting the corn into the silo at the most advantageous time.

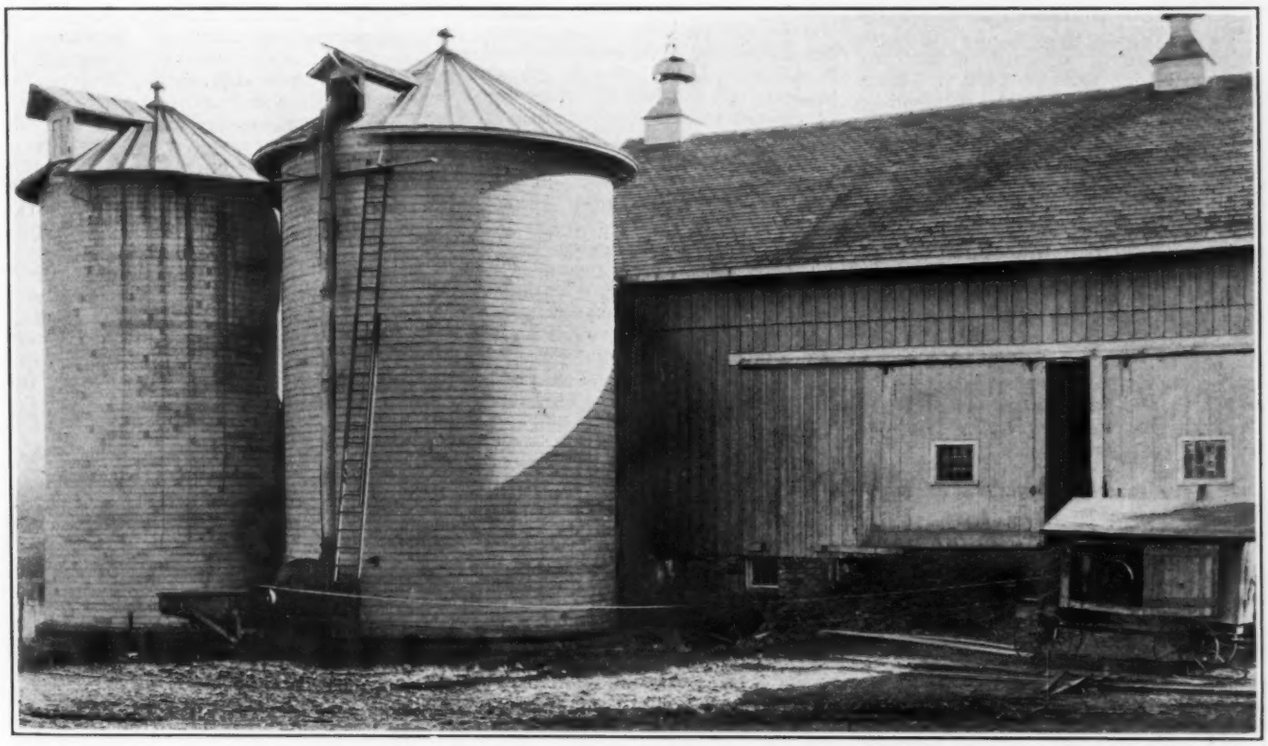
There is less investment with the motor than with the tractor. The motor is convenient and requires little skill in operating. It requires no attention while running and there is no starting difficulty. It may be stopped at any time when corn is not available.

Depreciation is very slight. A motor for this service would last a lifetime, barring accidents.

The disadvantages of the motor drive are: The motor is good for belt work only. It cannot be used for traction or for moving itself as a machine to be operated from place to place. The addition of a motor of this size to the farm requires a larger transformer for this service, which increases the demand charge and raises the minimum bill. This is on throughout the year or else a charge for installing and removing the transformer must be made.

The cost of fuel is a very small part of the total cost, and the difference between the cost of electric energy and the cost of fuel has little bearing on the total cost.

It would seem that the greatest use for electric silo filling would be on farms where a tractor is busy with other work or where tractors cannot be used or where there is a demand for a utility motor, providing a cutter can be obtained that will run on a fairly small motor, say 5 or 7½ hp.



MOTOR-DRIVEN ENSILAGE CUTTER READY FOR OPERATION AT SILO

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Hydro Stations in Cenischia, Italy.—J. REYVAL.—Fed by the watersheds from the slopes of Mont Cenis in the far north of Italy, the River Cenischia supplies the motive power to three interconnected hydro-electric stations with a combined output of about 80,000 kw. and an anticipated production of 180,000,000 kw.-hr. annually. The first plant operates under a head of 630 ft. with three Pelton-wheel-driven generators of 3,000 kva. and two of 1,600 kva. at 375 r.p.m. Three corresponding transformer banks step the voltage up to 31,000 for transmission to the second station at Venaus. The hydraulic equipment of this plant is of particular interest, as its three Pelton turbines operate under the unusually high head of 3,400 ft. Each wheel drives a 21,200-kva., three-phase generator at 500 r.p.m., delivering 7,000 volts at 50 cycles with an efficiency of 96.35 per cent under full load and 0.75 power factor. The machines are totally inclosed and self-ventilated. During the winter months the hot-air exhaust is utilized to heat the nearby transformer and switch house. Three water-cooled main transformers elevate the generator voltage to 75,000 for transmission to Turin. The third station, at Susa, is at present under construction. The article comprises 33 pages and 54 illustrations.—*Revue Générale de l'Electricité*, May 1, 8 and 15, 1926.

Generation, Control, Switching and Protection

Remote-Controlled Substations.—W. C. BLACKWOOD.—This article describes a unit type of distribution substation which has been designed for a metropolitan district. In 1925 it was necessary to provide additional substation capacity in the district supplied by the Jamaica (Long Island) substation in Greater New York, and three means of accomplishing this were considered—first, to increase the size of the present substation at Jamaica; second, to build another similar attended station; third, to build a smaller unattended station for automatic operation or remote control and to provide for future growth by the erection of other similar unit unattended stations. A study of plans indicated that the cost per kva. of a large attended station and that of a small unattended station with automatic features or remote control were approximately the same, owing to the greater simplicity of the smaller station. The station is unattended and all operations are controlled from a distant attended station. The cost of operation per unit of capacity is no greater than for a much larger attended station. Remote control was adopted rather than automatic operation because of the nature of the load and territory served where service with minimum interruption is demanded. The first substation of this type was erected in Woodhaven about 2½ miles from the Jamaica substation. Three 3,750-kva., three-phase oil-insulated, self-cooled transformers were installed. The rated capacity of the station is 7,500 kva., one transformer being a spare. The station is fed by a 13,200-volt, three-phase, 500,000-circ.mil underground cable from the Jamaica substation and a similar cable from the Maspeth substation, approximately 5½ miles away.—*A.I.E.E. Journal*, June, 1926.

Transmission, Substations and Distribution

The Fundamental Considerations of Y-Grounding.—R. RÜDENBERG.—This article, written primarily for European consumption, where solid grounding of the Y-point on three-phase systems has not gained the same wide application as in America, is an interesting analytical study of all the factors which must be considered on extended networks so connected. The author investigates the electric stresses for insulated and grounded neutral, shows and compares the magnitude of short circuits and grounds and elaborates on the distribution of current in the ground in case of a fault. To aid the last-named investigation the writer gives a valuable tabulation of ground resistance for various sizes and shapes of ground electrodes. He compares the spreading of direct and alternating current in and along the ground under transmission lines and gives a formula to calculate the dangerous area around transmission towers. He finally investigates the disturbing influence of power lines with grounded neutral upon telephone lines. The following conclusion is reached: It does not seem possible to avoid entirely the leakage of current with a frequency of 50 cycles or its third harmonic at 150 cycles into the ground. Only frequencies considerably above these values are detrimental to telephone lines. It is therefore suggested that power systems must guard against the leakage of high-frequency current into the ground and that telephone systems should install filters to bypass low frequencies. —*Elektrotechnische Zeitschrift*, March 18 and 25, 1926.

Regulator Controls Breathing of Power Transformers.—L. H. HILL.—This article describes in detail the construction, application and operation of the breathing regulator equipment for large transformers of the "Inertaire" type. Filling the space over the oil in the tank with an inert gas, such as nitrogen, accomplishes four purposes. It prevents the oil from oxidizing, keeps moisture out of the oil, reduces the fire hazard, and provides a cushion in the transformer tank in case of an explosion in the oil. With this type of transformer the breathing is reduced by the use of a breathing regulator, so that the life of the chemicals is considerably prolonged. The regulator controls the breathing of the transformer by maintaining the pressure in the transformer tank between predetermined limits.—*Power*, June, 1926.

Units, Measurements, and Instruments

New Mechanical Test for Rubber Insulation.—C. L. HIPPENSTEEL.—This paper discusses the development of a rapid routine test which will numerically express the ability of rubber insulation to resist cutting by the conductor at the points of support and to resist cracking at points of extreme flexure. Up to the present time no one test of that nature has been described. This test is not yet fully developed but gives sufficient promise to justify the hope that it will merit a fuller report at a later time.—*Bulletin Reprint B-197, Bell Telephone Laboratories.*

Some Characteristics of Quenching Curves.—H. J. FRENCH and O. Z. KLOPSCH.—This report concerns time-temperature cooling curves at the center of steel samples of various sizes and shapes quenched into ordinary coolants, such as water, a commercial quenching oil and air. Based on a series of experiments, a method is outlined by which cooling curves for various sizes and shapes quenched from various temperatures can be derived, provided the curve for one size from one quenching temperature is available and one constant is known for the coolant. As far as was practicable the comparisons contained in this paper were made with results of other investigators, and they show that direct experimental confirmation is available for the described empirical formulas, covering a wide range in conditions. The article concludes with a detailed summary of the main features of the described experiments.—*Paper No. 513 of Bureau of Standards.*

Illumination

Production and Application of Light.—T. F. MILLAR.—This A.I.E.E. committee report constitutes a brief résumé of the progress of the lighting art, including recent developments in double-filament automobile lamps and prefocusing lamp sockets. Residence, school, railway, bus and signal lighting are taken up in succession, and the report concludes with a reference to the standardization of nomenclature, abbreviations and symbols in the illumination field.—*A.I.E.E. Convention Report*, June, 1926.

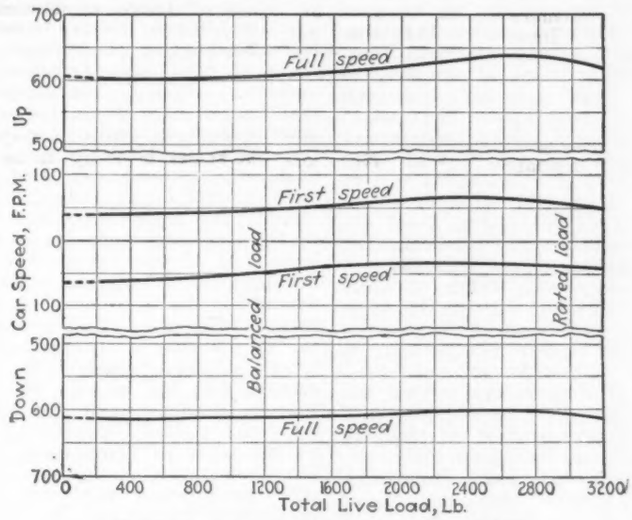
Electrophysics, Electrochemistry and Batteries

Alkali-Metal Photo-Electric Cell.—HERBERT E. IVES.—An indispensable requirement in the electrical transmission of pictures is speed in conveying the picture from one point to another. The choice of a method of transforming light and shade into an electrical current would therefore, other things being equal, be that method which required the least time for the transformation. In choosing a photo-sensitive device certain requirements are to be met. Particularly it had to be as nearly as possible instantaneous in its action. The field is more or less limited to the photo-electric cell, of a type in which the effect of light is to release electrons from the surface of the light-sensitive element and so cause an electric current to flow in the space between the

light-sensitive surface and another electrode. Photo-electric cells are considerably less sensitive than the best variable photo resistances, but while this characteristic made them difficult to utilize in the earlier days of picture transmission, the development of vacuum-tube amplifiers remedied the deficiency. All of these requirements pointed to the alkali-metal photo-electric cell as developed by the work of Elser, Geitel and others. — *Bulletin Reprint B-195 Bell Telephone Laboratories.*

Motors and Control

Elevator Equipment in an Office Building. — C. A. CALLAWAY. — The article describes in detail the elevator equipment of the Equitable Life Assurance Society's 22-story building in New York City. The main passenger elevators, 24 in number, are divided into four banks of six cars each, two banks on either side of the main lobby, and are operated by a modified form of variable-voltage or Ward Leonard control which embodies a number of new features. A gearless freight elevator is provided, with rheostatic control, serving the building from the second sub-basement to the twenty-second floor. While this elevator is normally rated at 3,000 lb. at 600 ft. per minute, it has a maximum capacity of 6,500 lb. at reduced speed, if counterweighted for 50 per cent of the total load. It is somewhat of an innovation to provide a high-grade, high-speed gearless elevator for freight service, and the results thus far have justified this provision. A similar gearless rheostatic passenger elevator is provided for special service in one of the outlying wings of the building and runs from the second to the eighteenth floor. A geared rheostatically controlled elevator for executive office service operates from the seventeenth to the twenty-second floor and is designed for handling a maximum load of 1,500 lb. at 250 ft. per minute. Two service elevators of the hydraulic plunger type operate from the second sub-basement to the first floor for freight service only.— *Power*, June 22, 1926.



SPEED REGULATION CURVES AT SLOWEST AND HIGHEST CAR SPEED

Heat Applications and Material Handling

Wire Drying and Annealing. — The application of electric heating to furnaces for drying and annealing wire and similar products is growing rapidly in favor. One such installation is used at the National Screw & Tack Company's works, Cleveland, for drying acids from rods before drawing them. Natural gas had been used previously as fuel. The electrically heated furnaces were found to have much greater capacity, three electric ovens replacing seven gas-fired ones. An installation has been made at the Worcester plant of the American Steel & Wire Company for the continuous hardening and tempering of steel wire. A somewhat similar operation is being accomplished by the Columbia Steel Company at Elyria, Ohio, where stripped steel is being continuously annealed through electric heating. A new development in electrically heated furnaces is the continuous furnace for normalizing. There are a number of these furnaces to be installed in the near future.— *Iron and Steel Engineer*, June, 1926.

Traction

Economies of Steel-Plant Railroad Electrification. — O. NEEDHAM and DAVID C. HERSHBERGER.—For the purposes of this article the authors have assumed a typical steel plant having both systems of trackage — namely, narrow-gage comprising 9 miles of track and standard-gage comprising 40 miles of track. The narrow-gage railroad system is distributed around the open-hearth furnaces and the mills in close proximity to the building and is confined to a relatively small area and trackage. The standard-gage railroad system is distributed throughout the plant, taking care of transportation involving the use of standard railroad cars, ladle and slag cars, etc. The track gages for the narrow-gage railroad system comprise such dimensions as 24 in., 30 in., 36 in., etc. The rail weight varies from 75 lb. to 85 lb. per yard, the latter value predominating for steel-plant work. Standard-track gage is 4 ft. 8½ in. between rail heads, except that on curves a slightly increased dimension is used for facilitating locomotive running. Rail weights usually in the neighborhood of 100-lb. per yard are used. The narrow-gage locomotives are used to serve the open-hearth furnaces and mills. They are employed to haul hot ingots in molds from the pouring floor to the strippers and ingots from the strippers to the soaking pits. They are also used in the scrap yard hauling scrap to the open-hearth furnaces, etc. Part of this work is continuous, while some takes place at regular intervals and requires that locomotives be available without fail at these times. The study of electrifying these roads was confined to the two most promising systems of electrification for steel-mill yard work. These two systems are the 250-volt direct-current third-rail system and the Diesel-electric locomotive. The tables included in the article show the work conditions and give the minimum return that can be expected from electrification. The 250-volt direct-current system, employing third-rail-type locomotives, was determined to be the most economical system of transportation for steel-plant yards. The return on the investment as compared with steam operation is excellent and fully justifies the displacement of steam by electromotive power. A number of partial installations of this type are in operation with excellent results. The Diesel-electric locomotive occupies second place as regards operating economy and return on investment compared with the third-rail locomotive. The electric locomotive receiving its power from a conductor is the most reliable unit of motive power in existence. The third-rail-type locomotive has desirable features of operation that it will be difficult for other types to equal. It is quickly made ready for service, and its power is not limited by any local power plant on the locomotive itself for the reason that it has the steel-mill power system behind it. It can handle heavy loads at moderate speeds, and its general performance recommends it over other types of locomotives when a suitable conductor system can be installed. —*Iron and Steel Engineer*, June, 1926.

COMPARATIVE OPERATING AND INVESTMENT COSTS FOR THIRD-RAIL-TYPE, DIESEL-ELECTRIC AND NEW STEAM LOCOMOTIVES

	Locomotives		
	Third-Rail	Diesel-Electric	New Steam
Standard-Gage Railroad			
Operating cost	$218,275	$248,200	$479,900
Fixed charges	120,000	153,800	56,300
Total annual charge	338,275	402,000	536,200
Yearly saving over steam	197,925	134,200	.....
Investment	888,000	1,025,000	375,000
Per cent saving on investment	22.3	13.1	.....
Narrow-Gage Railroad			
Operating cost	$184,880	$189,250	$307,000
Fixed charges	59,500	124,000	60,500
Total annual charge	244,380	313,250	367,500
Yearly saving over steam	123,120	54,250	.....
Investment	441,700	827,000	402,600
Per cent on investment	27.9	6.55	.....

New Books

Elements of Radio Communication

By Ellery W. Stone, U.S.N.R. New York: D. Van Nostrand Company.

Here is the third edition of this work, which has been revised in line with modern practice. As its title states, it carries its assiduous reader up from the definitions of fundamental units and terms to an understanding of the esoterics of radio communication, and it performs this feat with the use of no higher mathematical ladders than simple algebra and elementary trigonometry. This is a book for the student or the earnest amateur who wants to learn the subject, and it is not at all one "recognizing the new devices and improvements which have become popular within the past year." For the man who wants information about the new developments in broadcast reception the book will not be of great value, but for those whose interest extends beyond broadcast reception to the whole field of radio communication it fills the bill admirably.

Die Transformatoren

By Dr. Milan Vidmar. Second edition. Berlin: Julius Springer. 750 pages, 320 illustrations.

The demand for an up-to-date and practical book on the design of transformers is best shown by the fact that the first edition of this book, issued in 1920, was quickly out of print. Men in practical life as well as students found Vidmar's book an excellent source of reference for the many problems surrounding the calculation and design of modern transformers. It was to be expected that in the wide circle of readers some would find certain shortcomings in the text of the first edition. The author himself joined these critics, realizing the omissions and errors in some chapters, and an enlarged and improved second edition was planned soon after publishing the first. The new edition is now available, and most of the former critics have been silenced. An entirely new chapter has been added dealing with the higher harmonics of the magnetizing current, a problem which enters so prominently in large power transformer design. The conception and calculation of forces in transformers under short-circuit stresses have been rewritten from a more modern viewpoint. The section on artificial cooling of transformers is considerably augmented by including present-day American types.

The author still devotes a surprisingly large space to the theory and design of air-insulated and air-cooled transformers. This type of transformer is at present decidedly on the decline, for reasons which practical use has proved to be valid. Since the writer admits that it has been his particular hobby for many years past, and since an elaboration of the theory of such machines is at least highly interesting, no detriment can arise from giving this added information. A very useful chapter on the frequently little considered but highly important ventilation of transformer cells is added. It seems as if still more room should have been devoted to design features of transformers for more than 66 kv. It is out of proportion to practical demand to give, for example, twelve pages of data on a transformer design for 60,000 amp. and only three pages for a type of 104,000 volts. The former is an interesting but exceedingly rare machine, while the latter will be encountered on every modern transmission system.

In many chapters the author emphasizes in a clear manner the most economical use of iron and copper in transformers designed for various purposes. Inasmuch as high-voltage machines require a large amount of insulation, similar rules of economy in regard to this expensive material would be well warranted. The cost of the insulation in a 110-kv. transformer is a very large item, well worth a close scrutiny. Data on this subject will be missed by many and could be added without fear of detracting from the conservative character of the book. The statement of the author (see Chapter 80) that theory and design of high-voltage bushings fall without the scope of a book on transformers, because the bushings are bought ready-made, is hardly true. Bushings are such integral parts of a transformer that the designer could rarely be satisfied with a possible market product, particularly since current transformers and voltmeter rings are now being used quite frequently. Both of these have to be designed to fit the bushing and fulfill their special use.

All the above suggestions, however, are merely offered as an aid to enhancing the completeness of this book in a possible next edition. Even without them, Vidmar's volume is beyond doubt the most up-to-date transformer book in existence. A. P.

Relay Handbook

By Relay Sub-committee of Electrical Apparatus Committee, Technical National Section, National Electric Light Association. New York: National Electric Light Association. 1,000 pages, illustrated.

Automatic protection of electrical equipment and systems has become a very important consideration in electrical engineering, and this book contains full information on all protective equipment, its application, its testing and its maintenance. Each type of relay is fully described and illustrated by characteristic curves and wiring digrams.

A complete treatment of trip mechanisms is included and direct-current protective systems are treated at length. But the most valuable work was done by the committee in treating of the principles of protection for systems and equipments. Each type of protection is fully discussed and its advantages and disadvantages are outlined. Secondary networks receive very complete treatment also. Other material on testing, setting, calibration, maintenance and records for relays complete one of the most valuable books of its kind, compiled by a committee of competent men.

The Principles of Sound Signaling

By M. D. Hart and W. W. Smith. New York: D. Van Nostrand Company. 139 pages, illustrated. Price, $4.

There is a definite need for additional literature on the subject of "acoustical engineering," and recently there has been positive evidence of an awakened interest in this subject. The publication of this book is therefore timely, and other books on the subject may be confidently expected in the near future. To identify the factors which affect acoustical efficiency the authors have analyzed the various processes and defined the individual efficiencies. However, in order to specify definitely the elements, they have introduced so many different efficiencies (production, conversion, supply, transmission, line transmission, reception, intensification, reconversion, over-all and system) that the reader is likely to be left in a rather confused state of mind.

In the chapter on "The Reception of Sound" the distorting effect produced by the receiving device upon the acoustical field is discussed. The authors call attention to the impracticability of describing the magnitude of the aural sensation in terms of definite units and to the difficulty of comparing the intensity of two sounds except where the signals are just audible, but suggest that in the absence of any alternative the "just audible" method be adopted as the basis of comparison, although the amount of acoustical energy necessary to produce this unit loudness varies with frequency. The reader will find in Appendix III a helpful discussion on "The Measurement of Acoustical Energy." Of the various mechanical detectors mentiond the "hot-wire microphone," on account of its great convenience and in spite of the difficulty of accurately calibrating it, is considered the most useful.

The advantages and disadvantages of the three types of intensifiers—mirrors, resonators and trumpets—are pointed out, the last two being of most importance. In the chapter on "Transmission of Sound" some interesting experimental results are given which check satisfactorily with calculated values based on experimental data. Noteworthy was the large decrease of pressure with the distance from the source. Further discussion of the experimental results is given in Appendix IV. The fading curves—variation of intensity with time—show clearly some of the difficulties encountered in this form of signaling. H. M. T.

Book Note

Engines of High Output. By H. R. Ricardo. London: MacDonald & Evans. 120 pages, illustrated.

The author deals with thermodynamic principles in the operation of internal-combustion engines. The theory is applied to high-speed engines of the modern types using oil, gasoline, alcohol, benzol and other usual fuels. Heat losses, efficiencies, expansion and compression cycles are treated in fundamental terms.

News of the Industry

Generators at Wilson Dam Shut Down

Alabama Power Company Refuses to Pay Army Engineers' Rates for Primary Power with Stipulation Giving Hydro Output Preference Over Steam Product

DELIVERIES of power from the Wilson Dam at Muscle Shoals were suspended July 3, when the Alabama Power Company declined to accept conditions as to operating methods and a new schedule of rates proffered by the Corps of Engineers of the United States Army. As this is written, however, an agreement which will result in the re-establishment of service seems to be imminent. With the closing down of the waterwheel generators the Alabama Power Company started up the steam installation at Nitrate Plant No. 2. This plant has a capacity of 60,000 kw.-hr., which is 24,000 kw.-hr. less than the maximum amount of hydro power which can be handled with the present transformer installation.

When the War Department entered into an informal agreement to furnish hydro-electricity at 2 mills a kilowatt-hour, it was explained by the army engineers, it was to be on a basis of "if and when available." During the testing period dump power was being sold; now, these engineers contend, it is primary power.

Representatives of the Alabama Power Company point out that the power would be worth much more were it possible to make a contract for a definite period, but this the department is not in a position to do. For that reason, the power company men say, they must be prepared at all times to start the steam plant. Thus a portion of the fuel saving is offset by the expense of being in readiness. The engineer officers who devised the proposed schedule sought to give the government the advantage of at least the full amount of the coal saving plus the operating charge.

The schedule of rates proposed by the engineers is 6 mills for that part of hydro-electric power substituted for steam power generated at the Sheffield plant, 4 mills for that substituted for power from the Gadsden plant and 3 mills for that substituted for power from the Gorgas plant.

There would be no great difficulty in reaching an agreement as to the price of the power, say the representatives of the Alabama Power Company, but the operating conditions imposed are not acceptable, since under them the company would have to agree not to operate steam plants if that would prevent the use of the maximum amount of hydro-electric power that can be taken away. This represents the view of those who would see everything revolve around the Wilson Dam, it is contended; but the engineers of the Alabama Power Company point out that they must get the most out of their interconnected system, which would not be possible under the operating methods suggested by Major Max Tyler. A counter proposition submitted by the Alabama Power Company proposes a sinple flat rate on the basis of 1,200,000 kw.-hr. annually.

The first session of the Sixty-ninth Congress closed without an effort to bring the Muscle Shoals bill to a vote. Friends of the measure came to the conclusion that it would attract more votes after election than before.

Thompson President U. G. I.

President of Philadelphia Company and Duquesne Light Accepts New Office—Bodine Chairman

ANNOUNCEMENT that Arthur W. Thompson, president of the Philadelphia Company and the Duquesne Light Company, now controlled by the Byllesby interests, had accepted the presidency of the United Gas Improvement Company aroused no little interest in financial and utility circles this week. Mr. Thompson succeeds Samuel T. Bodine, who becomes chairman of the

A. W. THOMPSON

U.G.I. board in succession to the late Randal Morgan. A biographical notice of Mr. Thompson is printed under "Men of the Industry" on page 88.

The United Gas Improvement Company, with headquarters in Philadelphia, ranks with the most important of the utility holding companies, controlling electric light and power, railway and gas properties in many states. Among electrical properties it controls or in which it has a substantial interest are the Syracuse (N. Y.) Lighting Company, the Iowa Light, Heat & Power Company, the Sioux City (Iowa) Gas & Electric Company, the Counties Gas & Electric Company, operating in territory near Philadelphia; the Connecticut Light & Power Company of Watertown, Conn.; the Meriden (Conn.) Electric Company, the Charleston (S. C.) Consolidated Railway & Lighting Company and the St. Augustine (Fla.) Gas & Electric Light Company. It also owns stock in the new Mohawk-Hudson Power Corporation.

Mohawk-Hudson Wants to Buy Syracuse Lighting Stock

There will be a hearing before the New York Public Service Commission at New York City on July 15 on the application from the Mohawk-Hudson Power Corporation to acquire all or more than 10 per cent of the common and preferred stock of the Syracuse Lighting Company, the Seneca River Power Company of Baldwinsville, N. Y., and the Mexico (N. Y.) Electric Company.

To Give Customers Rebate

Worcester Electric Light Company, Paying 46 per Cent Dividend, Will Halve October Bills

HAVING just declared a 30 per cent extra dividend, amounting to $720,000, to stockholders of record on June 30, payable July 12—a total of 46 per cent for the year—and desiring to share this culmination of its long-standing prosperity with its customers, the Worcester (Mass.) Electric Light Company announces that for the month of October next all its customers except other utility companies will receive a 50 per cent cut in their bills.

The par value of the Worcester Electric Light Company's stock is $25 per share, and 96,000 shares will participate in the extra dividend. The estimated rebate to customers is $136,000. It will affect 45,000 accounts. The city of Worcester will save about $10,300 on street and public building service in October.

Report on New Hampshire's Power Survey Out

A 57-page pamphlet report on the New Hampshire power situation was made public this week at Concord by a committee appointed by President R. D. Hetzel of the State University to assist in a survey of the resources of the Granite State which is closely affiliated with the New England Conference movement. The report is signed

by former Gov. Robert P. Bass, Gov. John G. Winant, R. H. Spaulding, Allen Hollis and W. T. Gunnison, chairman of the New Hampshire Public Service Commission. It reviews the history of power development in the state, the rise of superpower and interconnection, compiles much interesting comment by utility leaders and publicists on these topics and outlines the major problems of rural electrification from the economic standpoint. Much useful information is embodied in the report upon the cost of steam power, water-power resources and storage developments and opportunities.

The report makes no recommendations as to legislation or policies, but calls attention to various problems of regulation and conservation which the committee deems important, including the holding company, financing and the development of storage by the state or otherwise. It comments on the present-day tendency to consolidation, saying: "Two-thirds of the generating capacity of central power stations in New Hampshire has come into the hands of two companies, the New England Public Service Company and the New England Power Company. Both are controlled outside this state."

Treasury Analyzes Muscle Shoals Bids

Percentage of Return on Investment of United States Shown to Be 2.828 from Air Nitrates Offer Against 3.252 or 4.432 from United Companies

By PAUL WOOTON
Washington Correspondent ELECTRICAL WORLD

JUST before Congress adjourned the Treasury Department submitted a comparative analysis made by it, at the request of the joint congressional committee on Muscle Shoals, of the bids for leasing the government's plants at that site made by the Associated Southeastern Power Companies and the Air Nitrates Corporation (American Cyanamid Company) and the former bid by Henry Ford. A summary of the Treasury's analysis in tabulated form appears below:

TREASURY ANALYSIS OF MUSCLE SHOALS BIDS

Dam No. 2, Dam No. 3 and Steam Plant, All Fully Equipped

	Associated Power Companies	Air Nitrates Corporation	Henry Ford
I. Without headwater storage:			
Present worth of future payments	$54,627,610	$45,832,283	$45,986,482
Interest return to United States on its total investment of $80,772,342, per cent	3.252	2.828	2.798
II. With headwater storage:			
Present worth of future payments	$78,695,930	$45,832,283*	$45,986,482*
Interest return to United States on its total investment of $80,772,341, per cent	4.432	2.828	2.798

* Neither the offer of the Air Nitrates Corporation nor that of Henry Ford provides for any increased return to the United States for headwater storage.

Certain interesting facts develop from this analysis:

1. The offer of the Air Nitrates Corporation returns but 2.828 per cent on the investment of the United States, and not 4 per cent, as has been the common understanding. The offer of the Air Nitrates Corporation is worded so that a reader is led to believe it provides 4 per cent interest return to the United States on its investment, but the bidder stipulates that this is to apply to the expenditures made by the United States reduced by all amounts expended prior to May 31, 1922, or $20,738,404. That is, the bidder asks a deduction of 41.7 per cent of the total of $49,734,335 expended by the United States up to date. The effect of this deduction of capital and the arrangement of deferred payments is that the offer will return only 2.828 per cent on the total investment that the United States must make under the contract.

2. The Air Nitrates offer provides no payments beyond this 2.828 per cent. There can be no possible retirement of the capital investment by the United States or of any part of it. The Air Nitrates offer is worded to create the impression that in addition to 4 per cent interest return a fund will be created to pay back to the United States the total investment within one hundred years. The Treasury analysis clearly shows that only 2.828 per cent interest will be received on the investment and that no money would be available to repay any of the principal.

3. The offer of the Air Nitrates Corporation is nearly the same as the Henry Ford offer. The Ford offer on a 50-year basis returns 2.798 per cent, whereas the Air Nitrates offer returns 2.828 per cent. It is noticeable that the bidder carefully calculated his payments to have an offer "as good as the Ford offer" and but slightly better.

4. The Associated Power Companies' offer returns 3.252 per cent interest on the total investment if no headwater storage is constructed, and 4.432 per cent interest if headwater storage is constructed in ten years. The Associated Power Companies' offer, even if no storage dams are ever constructed, is better than the Air Nitrates Corporation's offer by the difference between 3.252 per cent return and 2.828 per cent. If headwater storage is constructed in ten years, the Associated Power Companies' offer is better by the difference between 4.432 per cent and 2.828 per cent.

5. The Associated Power Companies' offer, if headwater storage is constructed in ten years, will return 4 per cent interest to the United States on the yearly balances of the total investment and in addition repay to the United States $66,015,946, or 81.7 per cent of the intital investment. This is within the 50-year lease period, at the end of which time the United States will also have returned to its possession the entire power properties.

6. The above facts are interesting in view of the following criticism of the Associated Power Companies' offer contained in the American Farm Bureau Federation letter of May 17, 1926, addressed to members of Congress:

> 4. The Farm Bureau has always advocated payments to the government based on 4 per cent interest on a fair cost of the Muscle Shoals development. This policy will result in cheap power at Muscle Shoals. The power group offers large payments of cash to the government, which makes the cost of power high, no matter for what purpose it is used. This is especially true in regard to their payments for secondary power made primary by upper river development.
>
> 5. The lease provides no amortization feature to repay the government for its expenditure and eventually wipe out the investment, which is a requirement that the Farm Bureau has always advocated in all leases.

The Farm Bureau favors a return to the United States of 4 per cent interest on a fair cost of the Muscle Shoals development, but it is evidently satisfied with a return of only 2.828 per cent on the actual investment to the United States from the Air Nitrates Corporation.

The Farm Bureau criticises the Associated Power Companies' bid because it contains no "amortization feature to repay the government for its expenditure." Yet the Associated Power Companies' bid pays 4 per cent interest to the United States on yearly balances of the total investment and in addition repays into the Treasury $66,015,946, or 81.7 per cent of all amounts expended by the United States. The Farm Bureau would accept the Air Nitrates bid, which pays but 2.828 per cent interest and pays nothing in the way of a repayment of the money expended by the United States in Muscle Shoals.

The Farm Bureau claims that the Associated Power Companies have offered too much money to the United States for Muscle Shoals. It has made no comment on the possibility that the Air Nitrates offer of 2.828 per cent may be much too low. It has charged that the power companies can afford to pay more because they will pass the amount along to the consumers of electrical energy. This raises a question as to whether sound business men would consider a return of 4.432 per cent to the United States as exorbitant for the Muscle Shoals properties; also, as to whether the regulatory commission in the Southeastern States would permit the power companies to raise rates on the grounds of the cost of Muscle Shoals.

On the other hand, the Farm Bureau makes no comment as to how the benefits of the low price the Air Nitrates Corporation would pay are to be passed on to the people of the Southeast.

Much significance is attached to the Treasury Department's impartial analysis. It sets an example which is likely to be followed frequently by committees of Congress in the future. Had the trained actuaries of the Treasury

Department analyzed the Ford bid and other offers that have been made for the government's Muscle Shoals properties, many of the wild claims made by members of the Senate and the House could have been refuted immediately. Even the committees themselves have been guilty of great inaccuracy in some of the conclusions they have drawn from financial set-ups.

Steam as an Aid to Hydro

A.S.M.E. Meeting at San Francisco Hears Different Viewpoints on Extent of Its Field

STEAM power development as applied to systems primarily hydro-electric was the leading subject at the hydraulic session of the spring meeting of the American Society of Mechanical Engineers, held at San Francisco on June 30. Three papers were presented: "Aspects of Steam Power in Relation to a Hydro Supply," by A. H. Markwart, Pacific Gas & Electric Company; "Water Power and Steam Power in California Utilities," by H. A. Barre, Southern California Edison Company, and "Speed Changes of Hydraulic Turbines for Sudden Changes of Load," by E. B. Strowger, Niagara Falls Power Company, and S. L. Kerr, Jr., William Cramp & Sons.

The ideas and points of view of Mr. Barre and Mr. Markwart differed. They agreed that for the most efficient development of water resources a combined steam and hydro program is essential. Mr. Markwart held that hydraulic power should be developed as fully as possible, not only from the power-supply standpoint, but because of the conservation of natural resources effected and because of service to rural load centers adjacent to transmission lines. He believed that steam power should be provided and a co-ordinated system built up to effect the best system economy for standby, for meeting the seasonal deficiency during the short-water period on non-regulated streams and for meeting the dry-year deficiencies. Mr. Markwart contended that with major steam-power plants power can be delivered at load centers for about 8 mills per kilowatt-hour and with a co-ordinated steam and hydro-electric system for even less than that, assuming oil to be as high as $2 a barrel.

With the same assumption as to price and with the efficiences of 425 kw.-hr. to 450 kw.-hr. per barrel effected at the new Seal Beach and Long Beach steam plants, Mr. Barre quoted fuel costs at about 2½ mills per kilowatt-hour. With this condition existing, he said that further development of stream-flow hydro plants is virtually out of the question and that even projected storage plants must be scrutinized more carefully than heretofor. Mr. Barre asserted that only an increase of several hundred per cent in fuel prices can change this condition. His statements caused much discussion, and the consensus of opinion seemed to be that he was letting the pendulum swing too far in favor of steam development.

In discussion of these papers S. A. Moss, General Electric Company, Lynn, Mass., gave facts and figures showing the influence of industrial development and demands upon the design and construction of steam plants on Eastern hydro-electric systems. He pointed out that this has made feasible the installation of units of from 5,000 kva. to 16,000 kva., and he voiced the question whether or not the industrial development of the Pacific Coast would bring about a similar condition. R. L. Thomas, Pennsylvania Water & Power Company, criticised Mr. Barre's statements as being extreme and cited numerous factors in favor of full development of all water-power possibilities. He suggested that steam might more properly be qualified as a standby for transmission lines than for hydro-electric plants. W. L. Abbott, Commonwealth Edison Company, Chicago, president of the A.S.M.E., in speaking of Mid-West experiences, pointed to the advisability of transporting fuels to centrally located steam plants rather than transporting power over long transmission lines. Discussion of this statement pointed to the need of considering the development of the territory traversed.

The paper on speed changes of hydraulic turbines presented a mathematical discussion of the problems incident to the study of that subject as conducted on a 70,000-kw. unit. Methods of determining governor time were noted in the paper and the relation of generator flywheel effect to speed variation was established. This paper was presented by R. S. Quick of the Pelton Water Wheel Company, who also enlarged upon a mathematical consideration of water hammer and its effects. Roy Wilkins of the Pacific Gas & Electric Company took exception to the assumption of any fixed values of penstock-pressure rise in making calculations. He also said that a practical solution of the problem of speed changes would be dictated by a proper economic balance between the costs of penstocks and the costs of turbo-generating equipment.

At the banquet on June 30 the A.S.M.E. medal was presented to Dr. Robert A. Millikan of the California Institute of Technology as a recognition of his unusual contributions to science and to engineering.

Federal Power Commission Still Busy

Further Study of New and Kanawha Rivers Under Way—White River Controversy Not Yet Settled—Licenses, Permits and Applications in Many States

BECAUSE of questions raised by the Federal Power Commission the Chief of Engineers is having a further study made of the New and Kanawha Rivers to determine if impulses caused by the release of water from the proposed reservoir on New River of the New River Power Company will affect navigation on the Kanawha. Gage readings indicate that the power waves from the Ivanhoe plant of the Appalachian Power Company do not reach the Kanawha, but it is contended that the type of gage used will not give an accurate indication of variation in discharge which affects the quantity of water without affecting the depth. Further checks are being made. An interesting feature of this investigation is the great scarcity of data on a matter as important as power waves, which on the Pit River in California persist throughout the length of the stream and for 120 miles down the Sacramento.

Indications are that the controversy over the development of the White River will be settled in Arkansas. If the Federal Power Commission is required to pass on the matter, it will be on the basis of which company has the best plan for utilizing the maximum resources of the stream. From evidence now before them the engineers of the commission are inclined to regard as better the scheme of development worked out by the White River Power Company, a subsidiary of the North American Company. The Dixie Power Company, a Couch interest, however, claims to have as good a plan and has promised to submit further data. State rights have been issued to both concerns.

The commission on July 6 authorized a preliminary permit for the Wabash Hydro-Electric Company covering a project on the Wabash River near Logansport, Ind. As the permit is, in effect, a transfer of rights to the company by its president, John Shafer, it will expire finally on June 26, 1927. A condition is that the transfer is not to augment pre-license charges.

A preliminary permit has been issued to the Tennessee Eastern Electric Company of Johnson City, Tenn., for a project in the South Fork of Holston River, in Sullivan and Washington Counties, Tenn., to consist of a dam 100 ft. high, about 10 miles upstream from Kingsport and creating backwater about 8 miles on the South Fork and 4 miles on the Watauga. Capacity will be approximately 60,000 hp.

The commission has authorized the issuance of a license to the Rose, Lane & Hobart Estate Company covering a project on Highland Creek in Alpine County, Cal.

The license issued to the Columbia Valley Power Company covering the Pelton and Metolius sites on the Columbia River has been extended for two years.

The preliminary permit of the Idaho Power Company covering a project at Twin Falls on Snake River has been extended until April 30, 1927. Other extensions of preliminary permits have been granted as follows: Frank M. Waring, Tyrone, Pa., until June 30, 1927; Juanita River Water Power Company and Watts Water & Power Company of Harrisburg, Pa., until April 30, 1927; Central Missouri Power & Water Company until June 26, 1927.

Dam No. 10 on the Kentucky River has been included in the preliminary permit of the Kentucky Hydro-Electric Company. The permit issued that company on Jan. 28, 1926, covered the United States dams on the river from

No. 8 to No. 14 inclusive, with the exception of Dam No. 10, for which a preliminary permit previously had been issued to the Winchester Waterworks Company. The latter permit expired March 4, and the waterworks company informed the commission that it did not desire to proceed further with the project.

Further extension has been denied of the license of Hutton, McNear & Dougherty covering a power project on Cascade Creek, in the Tongass National Forest in Alaska. The license has been extended twice, but the applicants have failed to carry out a prescribed agreement with the Forest Service.

The application of Henry W. Coe for rights on the headwaters of Toutle River in Washington, including storage in Spirit Lake, has been rejected on the ground of lack of market and interference with the scenic and recreational value of Spirit Lake. In addition, the water rights are involved in litigation.

The Southside Power Company of Richmond, Va., has applied for a preliminary permit covering a project on Roanoke River near Talley's Falls. Four units of 5,000 hp. each will be installed. The mean level of the river will be raised 40 ft. at the dam. The pool will extend 15 miles upstream. The power is for public utility use.

The Murtaugh Irrigation District of Artesian City, Idaho, has applied for a license covering its project on Snake River and Rock Creek. The initial installation will be two units of 5,500 hp. each.

Southeastern Power Company in Georgia

That the Southeastern Power Company as the result of recent acquisitions now controls most of the big power companies in Georgia is pointed out by Preston S. Arkwright, president of the Georgia Railway & Power Company, which will direct the work of the properties acquired in that state by the Southeastern. The Georgia Railway & Power Company serves 49 municipalities in north Georgia; the Georgia Southern Power Company serves fifteen communities, and negotiations are under way whereby this company will supply five more; the Athens Railway & Electric Company supplies light and power to Jefferson and other nearby towns as well as to Athens, and the Macon Railway & Light Company and Central Georgia Power Company supply power to many places in the central part of the state. Application for approval of the capitalization of the Georgia Utilities Company, recently incorporated, is now pending before the Georgia Public Service Commission. The properties which will be transferred to this concern, also controlled by the Southeastern Power Company, will supply light and power to sixteen communities.

"The Georgia Railway & Power Company," said Mr. Arkwright, "is already linked with the great power companies in Alabama, Tennessee, the Carolinas and other states. Under the control of the Southeastern Power Company the smaller companies in Georgia will be welded into one compact and efficient organization, and the wider the territory served by one system, the greater the variety of power users it will serve." He added that interconnecting lines will be constructed as needs develop and said that unified control of the companies would permit the strategical location of steam stations and the conservation of the water supplies to prevent power shortages in times of drought.

College Professors to Study with General Electric

A party of 22 college professors, representing widely scattered American universities, recently arrived in Schenectady, N. Y., for the "professors' conference" at the General Electric works, which will continue until July 31. They have been assigned to various departments, where they have begun active studies. This delegation, according to M. M. Boring, who is in charge, has for its object to become better acquainted with the progress and development of the electrical industry. Each member was allowed to select the line of work he was most interested in, and several signified varied interests and will be transferred from one department to another.

The twenty-two men and the universities are H. W. Anderson, Kansas; S. W. Anderson, Virginia Military Institute; F. C. Caldwell, Ohio State; G. H. Carlovitz, Vanderbilt; J. A. Correll, Texas; R. W. Dickey, Washington and Lee; J. L. Ellis, Georgia "Tech"; F. C. Evans, Cornell; W. B. Hall, Yale; S. F. Hart, Syracuse; H. H. Higbie, Michigan; E. W. Johnson, Minnesota; A. R. Knight, Illinois; J. H. Kuhlman, Michigan; K. M. McDonald, Alabama; G. E. Mercer, Lafayette; C. B. Parker, Syracuse; C. A. Pierce, Worcester Polytechnic; C. S. Rankin, Delaware; W. H. Setchell, Porto Rico; F. A. Spencer, Norwich, and B. B. Brackett, North Dakota. Eight other professors are spending the summer months studying in various departments of the company. They are John G. Pertsch and V. Karapetoff, Cornell; C. F. Greene and G. A. Goodenough, Illinois; C. E. Magnusson, Washington; J. M. Bryant, Texas; D. A. Bureau, Kentucky, and A. A. Bennett, Lehigh.

More High-Tension Lines for Ohio and Kentucky

Quite a program of transmission development is indicated as likely in the near future in Ohio and Kentucky. An important item concerns the Cleveland Electric Illuminating Company. This company, which expects to put an initial installation of 70,000 kw. into operation at its new Avon station by Aug. 1, has bought the right-of-way of the defunct Cleveland, Painesville & Eastern Railroad and will build on it a 70-mile, 132,000-volt steel-tower transmission line from Cleveland to Conneaut this year to supply Conneaut, Ashtabula and other places.

The Pennsylvania-Ohio Power & Light Company, Youngstown, plans to build 50 miles of 66,000-volt steel-tower line.

The Ohio Public Service Company may build a 51-mile, 132,000-volt line between Ashland and Canton, though definite decision has not been made. Another 75 miles at the same voltage, contingent upon the construction of a contemplated 60,000-kw. or 70,000-kw. generating station, is a possibility. No official statement is forthcoming on these projects, however.

The Kentucky Utilities Company will build 100 miles of 33,000-volt transmission line. It is also understood to be planning to raise the voltage on some existing lines in Kentucky from 33,000 and 66,000 to 132,000 and to interconnect them with Insull properties in Indiana.

Martin J. Insull Talks on Home Companies

At the annual conference of subsidiary managers and other operating employees of the Texas Central Power Company held in San Antonio recently Martin J. Insull of Chicago, head of the holding organization, said:

"I don't believe in 'foreign' corporations. I don't care whether you forget the existence of Middle West Utilities, and I don't care whether you know much about Central & Southwest Utilities, but I want every employee, from the telephone operators and the linemen to President James C. Kennedy, to know how to answer any reasonable question which may be asked about Texas Central Power Company. I want you to know and to spread the information that Texas Central Power Company is a home company, doing business in Texas and depending on the Texas public. It is your company, and its mission is to carry effective service at reasonable costs and to maintain at all times the most cordial relationship with the patrons and with the public as a whole. It is true we should build ahead of a community, but let us build in the right direction. We want to expand, of course, but we must look for reasonable returns for all the thousands who have intrusted us with their savings.

"The public utility business of the United States is run by men as honest as those of any other business in the world. I know that, and I want you to preach it as the truth. To be successful in any community, the public utility must have the confidence and the good will of the public. We want to serve at only a reasonable return and to show the courtesy to which the public is entitled as a matter of right.

"Another thing, this company has nothing to hide from the public. I should like to see everybody in every community touched by our service as familiar with the company as we are. It would help us for them to know us as we are. And I wish to repeat a statement President Kennedy has made to you before: We want to be, and we must be, a part of every community in which we operate. We must help in every civic work and lead in the community's developing program, for no concern has ever felt, or will ever feel, the development urge more than we feel and show."

Purchases and Mergers

Ohio Properties Unite—Other Transactions in Many States and in Various Sections

A MERGER of two power companies serving cities and towns in southern and eastern Ohio is announced. The companies are the Southern Ohio Power Company and the Ohio properties of the United Light & Power Company. The new holding corporation will be styled the United Ohio Utilities Company. The holdings of the Southern Ohio Power Company consist of the Southern Ohio Electric Company of Floodwood and Nelsonville, Athens Electric Company, Hocking Power Company and the Mutual Electric Company of Middleport. The consolidated properties of the United Light & Power Company are in Delaware, Hillsboro, Circleville, Gallipolis and Chillicothe. A contract has been signed with the Columbus Railway, Power & Light Company to connect its power lines with those of the merged corporation and a high-voltage line will be built into Chillicothe. The total capacity of the electric plants included in the merger is about 250,000 hp., and the value of the combined properties has been put at approximately $8,500,000, with annual gross earnings of about $2,000,000. B. J. Denman, Davenport, Iowa, vice-president and general manager of the United Light & Power Company, will be president of the United Ohio Utilities Company.

The Public Service Commission of Pennsylvania has approved the previously reported purchase by the Northern Pennsylvania Power Company of the Sayre Electric Company and the Susquehanna County Light & Power Company. The Northern Pennsylvania Power Company, formerly the Towanda Gas & Electric Company, earlier in the year acquired the North Penn Power Company. All its stock is owned by the General Gas & Electric Corporation.

Acquisition of the White Oak Light, Heat & Power Company, western Pennsylvania, and the plant serving the municipality of Clinton, Ky., was announced by the Associated Gas & Electric Company last week. Both recently purchased utility properties adjoin subsidiary companies of the Associated Gas & Electric, that in Kentucky lying next to the Kentucky-Tennessee Light & Power Company properties and that in Pennsylvania being adjacent to the Penn Public System, which the Associated company bought last year.

Purchase of five electric utility companies operating in northern Wisconsin and the Michigan peninsula is announced by the North American Company. The companies acquired are the Powers-Spaulding Light Company, the Dickinson County Public Service Company, the Aurora Electric Light & Power Company, the Amasa Lighting Company and the Alpha Lighting Company.

The Electric Utilities Company, recently organized by the Doherty interests and operating in Missouri, besides purchasing the Indian River Power Company, as already announced, has bought the Noel Mill & Power Company and the Electric Service Company. These three concerns supply Noel, Anderson, Lanagan, Pineville, Goodman and other places. The newly acquired properties will be connected with the high-tension system of the Empire District Electric Company at Neosho, Mo., and new substations erected.

The Empire District Electric Company, with headquarters at Joplin, Mo., has been authorized by the Missouri Public Service Commission to purchase from the city of Seneca, Mo., its municipal light and power plant, distribution system and transmission line between Seneca and Great Falls. The price to be paid is $25,000.

The Illinois Commerce Commission has authorized the purchase by the Roscoe (Ill.) Electric Company of the Cherry Valley Light & Power Company for $22,750 and properties of the Drager Electric Company of Winnebago for $50,000.

The Panola Electric Light & Power Company's plant at Sardis, Miss., has been bought by the Mississippi Power & Light Company.

Another company has just been bought by the W. B. Foshay Company. This is the Globe (Ariz.) Light & Power Company, which will be absorbed in the People's Light & Power Corporation.

The New Mexico Power Company has acquired the holdings and franchises of the Santa Fe Water & Light Company, which has been in receivership. E. N. Sanderson, New York, will be president of the board of the merged company, which will have an authorized capital stock of 10,000 shares of no par value.

Westby is the latest community in Wisconsin to turn over its electric business to a private company. A preliminary agreement, which has been forwarded to the Railroad Commission for approval, has been reached between the city and the Northern States Power Company for the purchase of the municipal plant.

Stone & Webster of Boston have offered $250,000 to the City Council of Sidney, Neb., for the municipal lighting and heating plant. If the Council accepts, the proposal will be put before the voters.

Boston Edison Adopts Area Rate for Domestic Users

The Edison Electric Illuminating Company of Boston has just adopted an area rate plan available for domestic customers in dwellings or apartments. The rate covers all service where the connected load includes either an electric range rated at 1,650 watts or more or an electric refrigerator. The rate is to be 8½ cents a kilowatt-hour for the first 3 kw.-hr. per month per 100 sq.ft., 5 cents a kilowatt-hour for the next 6 kw.-hr. and 3 cents for consumption in excess of this amount.

House area will be computed by taking the outside dimensions, excluding porches, bays and projections, and deducting walls, closets, etc., up to 30 per cent of the gross area so determined. Apartment area, where there is more than one apartment per floor, will be taken from the inside dimensions of all rooms and alcoves (walls included). Basements, attics and garages will be omitted unless used for living purposes; in that case they will be computed according to inside dimensions. The minimum area will be 1,000 sq.ft. and the minimum charge $9 per annum, payable monthly and adjusted yearly. No contract will be required, and the service can be terminated on ten days' written notice.

Diversified Program for Cedar Point Meeting

An especially full and well-diversified program has been arranged for the second annual convention of the East Central Division of the N.E.L.A., to be held at Hotel Breakers, Cedar Point, Ohio, July 13 to 16, bringing to a conclusion the geographic division meetings until the fall. A fine entertainment program is also promised.

The morning session on Tuesday will be given over to President W. R. Power's address, and a paper on rural electrification by J. B. Johnson. In the afternoon G. A. Iler will talk on "The Technical Section—Its Work and Accomplishments," J. L. Wright on "Economics of Single-Phase Meter Testing," H. E. White on "The Meter Department Accounting and Its Application," and A. D. Flint on "Maximum Demand and Its Relation to Industrial Sales." R. C. Fryer will report for the meter committee.

On Wednesday morning the entire program is to be devoted to the discussion of public relations problems. The following papers will be presented: "Customer Ownership," C. H. Brues; "Industrial Relations," G. M. Alexander; "Watchman, Tell Us of the Night," R. F. Pack; "What We Have Done and How We Have Done It," Helen E. Steiner; "The Overlooked Gold Mine in Utility Operation," Isabell Davie. In the afternoon "Our Relations with Financial Institutions" will be discussed by H. A. Fountain, "Shall We Stop or Go Ahead?" will be answered by Managing Director M. H. Aylesworth, "What the Bureau of Public Utility Information Is Doing" will be the topic of Fred J. Bollmeyer, "Public Relations and Their Importance" of Eric C. Hopwood, "Public Speaking and Its Effect on Public Relations" of Benjamin Ling and "Relations with Educational Institutions" of D. J. Hard.

Thursday morning Prof. A. M. Wilson will talk on inductive co-ordination, Dean Paul Anderson on "Why We Act Like Engineers," A. Carnegie on prime movers, L. E. Brown on surface condensers, William Shuler on electrical apparatus, and there will be an illustrated lecture on the Columbia Power station by F. D. Wyatt. A commercial session will be held in the afternoon, with reports by M. P. Walsh, J. G. Horgan, Walter Sammis, George Durban, K. Fitzpatrick, Jr., and H. W. Derry and addresses by Samuel Adams Chase and S. D. Heed. G. M. Miller and A. Bliss McCrum will report respectively for the overhead-underground system committee and the educational committee on Friday morning, and there will be a "round table" on the problems of the transmission and distribution engineer.

New Brunswick Plans Pass

International Commission Approves St. John River Project — Maine to Get 2,000 Hp.

THE International Joint Commission has granted the application of the St. John River Power Company covering a power development in New Brunswick but affecting the international aspect of the river. The commission a year ago authorized the New Brunswick Power Commission to develop this project. Subsequently, however, the people of New Brunswick voted against government ownership and operation, which made it necessary to grant new authority to the private company which now proposes to undertake the work. The applicant expects to construct its power house at Great Falls and to carry out the project in the same manner proposed by the provincial commission, except that the water is to be led to the power house by a tunnel instead of a surface canal.

The application was granted with the understanding that 2,000 hp. is to be exported to Maine for use in the United States. While all of this power is intended for use at a paper-manufacturing plant, some discussion was occasioned as to the possibility of the distribution of the power at some later date. The condition originally provided only for export of power for Maine. Some question arose as to whether or not that would permit the distribution of the power beyond the confines of that state. This rather remote contingency was provided for by the phrase "for use in the United States."

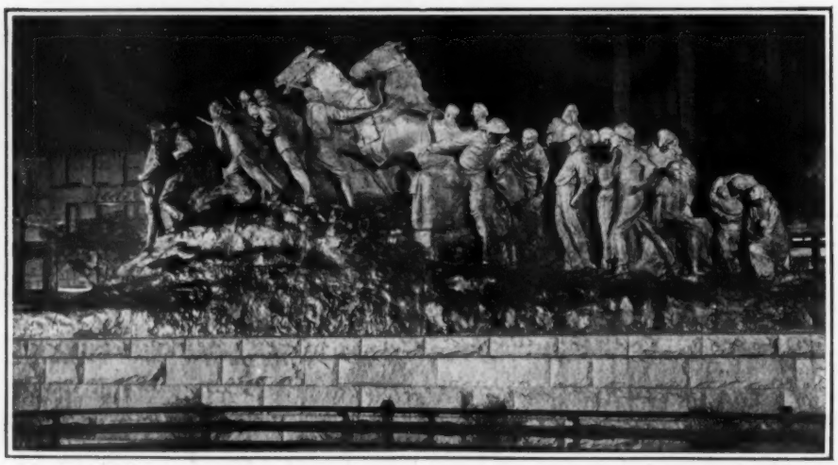
All the members of the commission attended the meeting. The American members are Clarence D. Clark of Evanston, Wyo.; Fred T. Dubois of Blackfoot, Idaho, and P. J. McCumber of Wahpeton, N. D. The Canadian members are Charles A. McGrath of Ottawa, Henry A. Powell of St. John, N. B., and Sir William Hearst of Toronto.

Controversy Still Rages Over Cumberland Lake Permit

Since the announcement in March of the application of the Kentucky Hydro-Electric Company to the Federal Power Commission for a preliminary permit to build a 134,000-hp. hydro-electric plant near Cumberland Falls, on the Cumberland River, a great deal of opposition to the plan has developed. Civic and business organizations at Louisville and in other parts of the state have joined with newspapers, both local and in distant cities, in protesting against the power development, arguing that it would ruin the beauty of the Cumberland Falls, this notwithstanding the insistence of the commission that enough water must be released in the daytime to preserve full flow. Some of the project's opponents have also the idea that an outside interest is stepping in to develop power which will be shipped outside of the state and which, even if produced cheaply, will not result in lower rates within the state.

There would be a solid concrete dam erected, 220 ft. high and 1,000 ft. long, which would submerge about 31,700 acres of land Power produced by this plant would be tied in with power produced at the Dix River plant, as well as with the steam plants at Pocket and Norton, Va., and Varilla and Pineville, Ky. Transmission lines would be interconnected at Louisville with other lines, with a proposed new interstate steam plant at Jeffersonville, Ind., and with the lines of the Louisville Gas & Electric Company, whose subsidiary, the Louisville Hydro-Electric Company, is now building a big water power-plant on the Falls of the Ohio River.

Floodlighting Newark's New War Memorial



NEWARK, N. J., is in possession of a new monument commemorating the "wars of America" which was unveiled on Memorial Day. It was erected from funds bequeathed for that purpose by Amos H. Van Horn and consists of a group of soldiers and civilians representing 1776, 1861, 1898 and 1917. For this monument the Public Service Electric & Gas Company arranged a floodlighting installation which was used at the unveiling. For this installation twenty sheet-steel General Electric projectors using 1,000-watt lamps were mounted on poles at various points throughout Military Park and on the roof of the Wiss Building and on the Public Service Terminal Building and their rays directed toward the monument.

Briefer News

Seattle to Erect New Substation.—The Seattle lighting department is planning to spend $650,000 on a new downtown substation and equipment for it and will also, it is announced, erect an office building at a cost of about $350,000.

To Develop Mistassini River in Quebec.—The Mistassini Pulp & Power Company has been organized by Canadian and United States capitalists headed by E. A. Wallberg and has obtained from the Quebec government the right to develop 30,000 hp. on the Mistassini River, which flows into St. John Lake, this right being conditioned on the erection of a pulp and paper mill by a definite date.

Ground for Duquesne Light Company's Shippingport Plant to Be Broken Next Spring.—Ground for the projected new steam plant of the Duquesne Light Company at Shippingport, on the Ohio River, which, it is estimated, will eventually cost $40,000,000 and which will rank with the great generating plants of the country, will, it is authoritatively stated, be broken next spring. The site has been acquired.

St. Louis to Have Searchlight Radiating Many Miles.—An electric beacon light that will be visible for 35 miles will be placed on top of the new 33-story Southwestern Bell Telephone Company building at Eleventh and Pine Streets in St. Louis. The light will serve aviators in locating St. Louis while flying at night. The building will be ready for occupancy in early fall.

Wisconsin Company's New Rural-Service Plan Approved.—The Wiscor in Power & Light Company's new uniform plan of financing rural-line extensions, which was described in the ELECTRICAL WORLD for June 19 (page 1360), has been approved by the Railroad Commission. This means that the plan will immediately be placed in operation in all of the 23 counties that the Wisconsin Power & Light Company and its subsidiary companies serve, which form the heart of the state's agricultural and dairy region.

Agreement Reached Over Use of Dam at Austin, Tex.—After several months of negotiation the Texas Power & Light Company of Dallas has entered into a contract with the city of Austin for taking over and rehabilitating the dam across the Colorado River there and supplying the city with light and power. (See ELECTRICAL WORLD for Dec. 26, 1925, page 1328). The ordinance adopted by the City Commission provides for the completion of the dam according to plans drawn by the company, for the operation of the city steam plant as a unit of the Texas Power & Light system, and for power service to the city at rates which will result in an annual saving of $57,000 for the next five years. The rehabilitation of the dam will cost more than $1,000,000 according to the company's

figures. The agreement will be submitted to the voters on July 31, and if ratified, the company will have two months in which to begin work.

Jacksonville to Double Its Municipal Plant.—Frank H. Owen, chairman of the Jacksonville (Fla.) City Commission, announces that it will be necessary to double the capacity of the city's generating plant at a cost of at least $2,000,000. The peak load of this plant has increased 45 per cent since 1921 and the industrial load 101 per cent. New equipment will include a 25,000-kw. turbo-generator, which with the auxiliary equipment, new substation and new distribution lines is expected to be ready in 1928.

New Connecticut-New York Interconnection to Be Built.—An important link in the New England transmission network will go under construction probably in a week or two. This will be a line between the Falls Village development of the Connecticut Power Company and the system of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y. The line will be about 40 miles long and of the steel-tower type, designed for initial operation at 66 kv. and ultimate operation at 110 kv.

Tularosa Valley, N. M., to Get Electric Service.—In connection with a large lumber mill which George Breece will construct at Alamogordo, N. M., there will be installed an electric light and power plant which will serve Cloudcroft, Tularosa, La Luz, Carrizozo and other points in the Tularosa Valley. The Ruidoso and other mountain resorts will eventually be connected with the plant, it is stated. The Breece lumber mill at Alamogordo will be driven entirely by electricity, slabs and other waste materials from the mill being used as fuel.

A New Hydro-Electric Plant Projected in Indiana.—Plans for a hydro-electric development at Cagles Mill, Ind., on the Eel River are announced by the Eel River Power Company, just incorporated. The site is in the southwest corner of Putnam County. The head obtained will be higher than any other in Indiana or contiguous territory. A dam 140 ft. high will impound a lake 28 miles long with a 100-mile shore line, and it is intended to develop the site, which is an hour's drive from Indianapolis, as a recreation park.

Coming New England Hydro-Electric Plants.—Details recently made public concerning the Bellows Falls (Vt.) hydro-electric development of the New England Power Company, on the site of old mill buildings purchased from the International Paper Company and razed, are to the effect that the installation will include three units of about 14,000 kw. each, or a total of about 42,000 kw. Development will include two high-tension switching stations, one on either side of the open tailrace. One station will tie in with the 66,000-volt line to Vernon and the lines north, while the second will be of a higher voltage and will handle the main outgoing load to the east. The estimated gross output of the Bellows Falls plant is about 150,000,000 kw.-hr. per year. A smaller development on the Deerfield River, to be known as the Sherman power station, will contain a single unit of about 7,500 kw. and is designed for automatic operation. Power from this plant will be stepped up to 110,000 volts and transmitted over a single-circuit line to the 110,000-volt bus at Davis Bridge. It is estimated that the average annual output of this plant will be 25,000,000 kw.-hr.

Officers of Public Utilities Advertising Association.—New officers of the Public Utilities Advertising Association were chosen at the recent meeting in Philadelphia as follows: President, Frank L. Blanchard, Henry L. Doherty Company; vice-presidents, George F. Oxley, National Electric Light Association, and H. M. Lytle, Chicago; secretary, Henry Obermeyer; treasurer, Charles W. Person. Though one of the youngest divisions of the International Advertising Association, the public service group reported a membership of more than 300, representing 225 utility companies throughout the country.

West Penn Power Company Starts Up New Unit at Springdale.—Officials of the West Penn Power Company announced last week that a new 40,000-kw. turbo-generator in the Springdale station had gone into service on June 28. This additional equipment, it was pointed out, became available in the same week that the completion of the Michigan City-South Bend 132,000-volt transmission line in Indiana (noted last week) brought about the realization of a continuous interconnected system from Chicago to Pittsburgh. From Windsor, W. Va., this system reaches to the West Penn stations at Charleroi and Springdale and thence to the circuits of the Duquesne Light Company.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

East Central Division, N. E. L. A.—Cedar Point, Ohio, July 13-17. D. L. Gaskill, Greenville, Ohio.

Association of Electragists International—Hotel Breakers, Cedar Point, Ohio, Aug. 24-27. L. W. Davis, 15 West 37th St., New York.

Camp Co-operation VI (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 1-4. (Society for Electrical Development, New York, is sponsor.)

Wisconsin Utilities Association, Electric Section—Eau Claire, Wis., Sept. 3 and 4. J. N. Cadby, 445 Washington Bldg., Madison, Wis.

Illuminating Engineering Society—Essex and Sussex Hotel, Spring Lake, N. J., Sept. 7-10. L. H. Graves, 31 West 46th St., New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 13-16. O. A. Weller, Public Service Co., Denver.

New England Division, N. E. L. A.—Poland Spring House, Poland, Me., Sept. 20-23. Miss O. A. Bursiel, 149 Tremont St., Boston.

International Association of Municipal Electricians — Battery Park Hotel, Asheville, N. C., Sept. 21-24. E. H. Benz, West New York, N. J.

Association of Edison Illuminating Companies — Chateau Frontenac, Quebec, Sept. 27-Oct. 1. P. S. Millar, 80th St. and East End Ave., New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 1 and 2. A. Bliss McCrum, secretary.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 4 and 5. C. H. B. Chapin, Grand Central Terminal, New York.

Oklahoma Gas & Electric to Have New Office Building.—Erection of an office building for the Oklahoma Gas & Electric Company will soon be started in Oklahoma City on a lot 80 ft. x 150 ft. at Third and Harvey Streets, with a connecting lot 60 ft. x 60 ft. Detailed plans have not yet been announced, but the building is to be a thoroughly modern structure designed to house executive, operating and accounting departments, sales and display rooms. It will be headquarters for properties serving 132 cities and towns with electricity.

Movement Against Illinois Commerce Commission. — The municipality of Peoria, Ill., is sponsoring a state-wide meeting, to be held there July 22, to which it is hoped to attract 700 representatives of Illinois towns and cities for the purpose of starting a campaign to secure an amendment to or modification of the public utilities act or to restore to municipalities to some extent powers of regulation of public utilities now exercised by the Illinois Commerce Commission. Decision to call this meeting followed recent Supreme Court decisions in two cases which the municipal heads declare nullify all city and village ordinances relating to the operation of public utilities.

Electrification of Pueblo's Steel Works.—The electrification of the steel works of the Colorado Fuel & Iron Company, Pueblo, is just about completed at a cost of $1,500,000, and indications are that preliminary try-outs in the power house will be made in July. The change from steam to motor drive will take place gradually with the minimum of interruption, and the complete change will not be made before fall. With one exception every rolling mill as well as the rail mills is undergoing electrification, and it is said that this is the most extensive application of electric drive to steel-mill work west of the Mississippi River. The plant is rated at about 40,000 hp. All the equipment was furnished and installed by the General Electric Company.

Improvements in Southeastern Massachusetts.—Activities in the central-station field in southeastern Massachusetts are rapidly increasing. In addition to the expansion of the system of the Montaup Electric Company interconnecting Fall River, the Pawtucket-Woonsocket district and Brockton with additional transmission facilities, the present 11,000-volt line supplying the Mansfield town plant from the Blackstone substation of the Union Electric Light & Power Company is to be rebuilt for 22,000-kv. service; new street lighting is planned for Mansfield and the Franklin district, and an enlargement of the Taunton light department plant is in early contemplation. On Cape Cod the Cape & Vineyard Electric Company has about completed the substitution of meters for the old flat-rate

schedule and is making many extensions to meet the demands of the fast-increasing summer population. The Southeastern Massachusetts Electric Company is pushing the wiring of residences for heavier service, and improved interconnections have been established with the Plymouth Electric Light Company.

Hydro-Electric Plans for Leevining Creek, Cal.—Application for the diversion of 30 sec.-ft. from Leevining Creek, in Mono County, Cal., for the generation of electric power, was filed with the State Division of Water Rights on June 22 by the Nevada-California Power Company of Riverside. The project involves an estimated expenditure of $1,170,000 on construction of a 20-ft. rock-fill concrete dam, an 1,800-ft. tunnel and 6,000 ft. of pipe line. By utilizing a fall of 1,681 ft. it is proposed to develop 5,731 theoretical horsepower, the commercial sale of which will be effected through the Nevada-California Power Company and the Southern Sierras Power Company.

Oswego Falls Corporation Seeks Additional Water-Power Rights at Fulton, N. Y.—Negotiations are under way whereby the Oswego Falls Corporation of Fulton, N. Y., which sells energy to the Fulton Light, Heat & Power Company, may obtain the water-power rights of the American Woolen Company, which generates 3,600 hp. in that city. The Oswego Falls Corporation has a power plant at Fulton and also possesses the right to develop water power on the eastern half of the Oswego River there. The woolen company, under a grant dating from 1790, has the right to one-half of the flow of the river at Dam No. 2 and is suing the State of New York for about $750,000 for alleged injury to its power interests caused by the State Barge Canal.

Progress of 110-Kv. Interconnection in Arkansas.—The Arkansas Light & Power Company has started work on a 110,000-volt H-frame line with aluminum steel-core conductors to extend from its system at a point near North Little Rock to Newport and Hoxie, a distance of 125 miles. It is estimated that the line will cost around $600,000. The same company has half completed the line from its substation at Crossett, Ark., to Lake Village, Ark., and Greenville, Miss., which will tie in with the system of the Mississippi Power & Light Company. This line will cost about $500,000, including the 350-ft. steel towers for the overhead crossing of the Mississippi River at Greenville. The lines are being built by the electrical engineering and construction departments of the company. The towers for the river crossing, which are being built by the Phoenix Utility Company, will support a 3,700-ft. span and will tie the Arkansas Light & Power and Louisiana Power & Light systems with the Mississippi Power & Light's system at two points, Greenville and Vicksburg. There will be another overhead crossing at the latter place. Eventually it is the expectation to connect the system with the Muscle Shoals system.

Men of the Industry

W. A. Jones Heads Public Relations Section

William A. Jones, who has been appointed chairman of the Public Relations National Section of the National Electric Light Association by President R. F. Pack, as announced in the July 3 issue of the ELECTRICAL WORLD, is affiliated with Henry L. Doherty & Company as chairman of the executive committee with headquarters in New York. Mr. Jones has been associated with the Doherty interests continuously since 1912, the year which marked his entry into the business world. From that date until 1921 he served as cashier, auditor, assistant secretary and treasurer of the Empire District Electric Company, the Ozark Power &

W. A. JONES

Water Company, the Carthage Gas Company and the Webb City & Carterville Gas Company at Joplin, Mo. It was in 1921 that he became a member of the Doherty executive committee. In addition, he is a vice-president and director of the Gas & Electric Securities Company and a director of the Central Ohio Gas & Electric Company, the Cities Service Company and the City Light & Traction Company of Sedalia, Mo.

Mr. Jones has been an outstanding figure in National Electric Light Association affairs for some time. He was treasurer of that organization in 1924-1926 and has also held the chairmanship of the Accounting National Section. In addition to heading the Public Relations National Section he has been appointed to membership on the committee on electrical resources of the nation. A native of Webb City, Mo., Mr. Jones was educated at the public and high schools there and at Vanderbilt University, Nashville, Tenn.

L. N. Ericksen of the staff of the United States Forest Products Laboratory, Madison, Wis., has received a year's furlough to undertake a survey of the lumber requirements of the Western Electric Company of Chicago. The principal aim of the survey will be to determine the suitability of different grades of lumber for various uses in the manufacture of electrical goods. A study of the practicability of the purchase of small ready-cut stock to meet the needs of the giant electrical equipment plant of the Chicago firm may also be made a part of the study. He expects to begin the investigation early in July. Mr. Ericksen, who is a graduate of the forestry division of the University of Minnesota, joined the Forest Products Laboratory in 1921.

A. W. Thompson New President of U.G.I.

Arthur W. Thompson, who was last week elected president of the United Gas Improvement Company of Philadelphia, as announced elsewhere in this issue of the ELECTRICAL WORLD, has been connected as president with the Philadelphia Company and its affiliated companies, including the Duquesne Light Company, since 1919. During the period which has elapsed he has directed the work of the utilities serving Pittsburgh and surrounding territory as chief executive, participating actively in all movements that made for the development of that district.

Mr. Thompson was born at Erie, Pa., in 1875 and was educated at Allegheny College, Meadville, Pa. While still in college he started his railroading experience and continued to engage in that phase of public utility work until his identification with the Pittsburgh utilities. He rounded out a period of service with the Baltimore & Ohio Railroad covering eighteen years in which he served successively as assistant division engineer at Pittsburgh, chief engineer of maintenance of way, chief engineer, third vice-president in charge of operations and vice-president in charge of traffic and commercial development. On June 1, 1918, during the war, he was made federal manager of several large Eastern railroads. Mr. Thompson is a director of several large organizations, including the Union Trust Company of Pittsburgh, Eastern Rolling Mills Company, the Pennsylvania Railroad and others.

George A. Johns, manager of the Central Power Company at Central City, Neb., has been transferred to the Ravenna district as manager.

R. C. Kumler has been transferred from the position of local manager at Durant to that of district manager, Shawnee district, to fill the vacancy caused by the death of W. S. Whistler.

J. N. Mahoney, formerly chief engineer and general manager of the Sperry Gyroscope Company, Brooklyn, N. Y., has been appointed manager of engineering for the American Brown Boveri Electric Corporation, with headquarters at Camden, N. J. Mr. Mahoney's engineering experience extends over more than 30 years in charge of manufacturing, operation, design and as a consultant. His connections have included the Electric Storage Supply Company, Boston; the Electrochemical Storage Battery Company, the New York &

Queens County Railway Company, the Electric Illuminating & Power Company, the New York Air Brake Company, the American Electric Brake Company, all of New York; the Westinghouse Electric & Manufacturing Company at East Pittsburgh, the Westinghouse Air Brake Company at Wilmerding, Pa., and more recently the Condit Electrical Manufacturing Company and the Sperry Gyroscope Company. Mr. Mahoney has contributed to the technical press from time to time and to the proceedings of the American Institute of Electrical Engineers, of which society he is a fellow, and to the National Electric Light Association, the Association of Iron and Steel Electrical Engineers and other technical societies. Many patents have been issued to him relating to apparatus for railway braking, railway control, fuse, switch and circuit-breaker apparatus.

H. E. Bowen, electric superintendent of the Oklahoma Gas & Electric Company at Sapulpa, has been transferred to Durant as local manager.

J. D. Caraway, formerly connected with the Oklahoma Gas & Electric Company at Oklahoma City, has been made manager at Elk City to fill the vacancy resulting from the death of W. D. Riggs.

D. C. Green, vice-president and general manager of the Utah Power & Light Company, has been elected a member of the board of governors of the Salt Lake City Chamber of Commerce.

Frank W. Smith, vice-president and general manager of the United Electric Light & Power Company, New York, was the guest of honor at a dinner given June 21 at the Union League Club by officials of the local public utility companies. The hosts for the evening were the five vice-presidents of the New York Edison Company, Thomas E. Murray, John W. Lieb, Arthur Williams, Philip Torchio and Harry M. Edwards. The occasion for the affair was the recent election of Mr. Smith to the chairmanship of the board of directors of the New York & Queens Electric Light & Power Company. The addresses following the dinner recounted Mr. Smith's record of 46 years' service in the electrical industry.

Washington Devereux, chief of the electrical department of the Philadelphia Fire Underwriters' Association, has been promoted to the position of supervising engineer for consultation and development work. Mr. Devereux has been continuously identified with the electrical industry in the United States and the West Indies since 1880, when he joined the Bell Telephone Company of Pennsylvania. He is the author of the "Electrical Key," the standard work for use of the Electrical Inspection Bureau, and has contributed substantially at discussions of the regulations and interpretations of the rules of the National Electrical Code. His society affiliations include many of the national electrical associations. **Robert M. Nesbitt,** formerly assistant to Mr. Devereux, has been made chief of the electrical department of the Philadelphia Fire Underwriters' Association.

G. G. Gale Assumes New Duties

G. Gordon Gale, vice-president and general manager of the Hull Electric Company, Hull, Quebec, has been appointed to the position of general manager of the Gatineau Power Company, a subsidiary of the Canadian International Paper Company recently organized to control the power developed by that organization on the Gatineau River. Mr. Gale will retain his executive position with the Hull Electric Company, also a property of the Canadian International Paper Company.

For many years Mr. Gale has occupied a prominent position in electrical circles in Canada and the United States. He is a graduate of the electrical engineering department of McGill University and prior to 1907 was assistant engineer of the electrical plant of the Canadian Rubber Company. In that year he became superintendent of power of the Hull Electric Company,

G. G. GALE

one year later being promoted to be acting general superintendent of the company, subsequently being named general superintendent. Five years later he received the title of manager and in 1917 assumed the duties of vice-president and general manager, his present position. Mr. Gale has devoted considerable attention to civic and association work, being active in the Engineering Institute of Canada and the Canadian Electric Railway Association, of which society he is a past-president.

Hylon T. Plumb, engineer of the Salt Lake City branch of the General Electric Company, has received the honorary degree of bachelor of science from Milton College. Mr. Plumb delivered the commencement address at that institution.

Frank B. Lawton, general superintendent of the Consolidated Power & Light Company, Huntington, W. Va., has resigned his positon to become assistant manager of the Virginia divison of the General Engineering & Management Corporation, with headquarters at Charlottesville, Va.

B. C. Cramer, formerly connected with the electric department of the Muskogee division of the Oklahoma Gas & Electric Company, has been transferred to Shawnee as superintendent of the electric department. **J. E. Spillers,** local superintendent at Poteau, will succeed Mr. Cramer. **L. A. Wiedman,** formerly connected with the Muskogee office, has been transferred to Poteau as local manager.

Obituary

Louis F. H. Betts, patent attorney, died June 29 as the result of an apoplectic stroke while on a fishing trip at Campbellton, New Brunswick. He was born in New York 56 years ago and was educated at Yale University. During his legal career he handled many important patent cases for the General Electric Company.

Frank E. Goodnow, who had been connected with the Public Service Company of Northern Illinois since 1909, died at his home in Evanston, Ill., May 27, after a long illness. Mr. Goodnow was serving in the capacity of electrical engineer at the time of his death. Following his early education in Adams, Mass., he attended the Massachusetts Institute of Technology at Boston and was graduated in 1908. In 1924 Mr. Goodnow was appointed by Mayor William E. Dever of Chicago as a member of the Chicago Radio Commission. Mr. Goodnow was 43 years of age.

Bert Weedon, 44 years old, a director of the Interstate Public Service Company of Indianapolis and traffic manager for the company, which operates interurban and light and power utilities in Indiana, died recently in an Indianapolis hospital. He had been in ill health for more than a year. Mr. Weedon was widely known in public utility circles of Indiana. Practically all his life was devoted to public service corporation work. He joined the staff of the Interstate Public Service Company as traffic manager in May, 1913.

H. W. L. Gardiner, business manager of McGraw-Hill publications on the Pacific Coast, died in San Francisco June 25. Mr. Gardiner in 1917 gave up his own advertising agency in Los Angeles, which had been very successful, to take charge of advertising in the Pacific Coast territory for the McGraw-Hill Publishing Company, at that time publishing eight journals. He rapidly built up the advertising department on the West Coast and, as the company acquired new papers, took on responsibility for the additional accounts that thus were added to the list. In recent years, in conjunction with H. C. Worden, Mr. Gardiner effectively handled the Western advertising accounts for all fifteen McGraw-Hill publications, making his headquarters at San Francisco. In the course of frequent trips over Coast and Mountain states during this eight-year period he made friends very extensively, and his passing will be felt as a loss throughout the West. Mr. Gardiner's death came unexpectedly and while he was in excellent health except for somewhat impaired eyesight. An operation for this eye trouble developed complications, and his death occurred only a few days later.

Commission Rulings

Circuit Breakers on Outskirts of Towns Insisted Upon.—Finding fault with the transmission equipment of the Consolidated Electric Light Company and ordering it improved, the Public Service Commission of Oregon made the following among other requirements: "Safety requires that an outdoor pole-type oil circuit breaker, mounted on a pole, with operating mechanism capable of being operated from the ground, protected by a fence so that only authorized persons may have access, be installed at or near the city limits of John Day and Canyon City, in order that either of these cities may be disconnected from the remainder of the system during a fire or other emergency."

Commission Without Jurisdiction to Order Refund of Cost of Extension Paid by Customer.—Declaring that the courts and not the regulatory body had jurisdiction in a complaint to compel the Philadelphia Suburban Gas & Electric Company to refund the cost of an extension paid by a consumer to obtain service under a contract by which he was to be repaid within a limited time a percentage of his bills and a specified amount for each additional customer connected to the extension, the Pennsylvania Public Service Commission said: "The gravamen of the complaint is that the company is indebted to complainant in a definite amount under a contract. No question of rates or service is involved."

Free Farm Service in Exchange for Right-of-Way Discriminatory. — The New Jersey Board of Public Utility Commissioners in granting the Jersey Central Power & Light Company's application for a finding that it was necessary for the company to condemn land for a transmission line declared discriminatory an agreement to supply electricity free for farm purposes if the farm owner would grant a right-of-way and giving him the right to reenter if the electricity was not supplied. The commission supported the company in declaring such an agreement invalid, despite the desire of the farm owner to abide by it, and said the company was not precluded from condemning other land until the grant referred to had been formally declared void.

Illegal Investment Made Through Ignorance Cannot Be Protected by Commission.—A dispute between the Carey Electric Light & Milling Company and the Southern Wisconsin Electric Company over the question of supplying electric service in the town of Bloomfield has been settled by the Wisconsin Railroad Commission in favor of the latter company, which charged invasion of territory. The commission said: "The testimony is clear that the objector is able and willing to render reasonable and adequate service at reasonable rates throughout the town of Bloomfield. The commission has consistently held that where a utility operating under an indeterminate permit is able and willing to render reasonably adequate service at reasonable rates public convenience and necessity do not require the operation of a second utility in competition." In 1918 the applicant, which had been serving residents of Kenosha County, extended a line on private property in the town of Bloomfield and rendered service to two customers therein. On this point the commission ruled that the illegal investment made by the company through ignorance could not be protected by the commission. The applicant had been in business as a public utility for a number of years prior to 1918 and had ample opportunity to obtain information through the commission.

Recent Court Decisions

Prima Facie Presumption in Favor of Commission Order Does Not Apply Where Material Fact Is Missing.—Reversing an order of the Oklahoma Corporation Commission in the suit of the Chicago, Rock Island & Pacific Railway vs. State, the Oklahoma Supreme Court said: "Prima facie presumption of the reasonableness, justness and correctness of an order of the Corporation Commission applies only to facts found by the commission or established by evidence on which the commission failed to make a finding. Where a material fact is lacking in the Corporation Commission's findings of fact and is not supplied by evidence, the presumption of the reasonableness, justness and correctness of its order does not apply and on review such order cannot be sustained." (245 Pac. 656.)*

What Constitutes an Indeterminate Permit?—Ruling that the power contract under which the Central Wisconsin Power Company, now owned by the Wisconsin Power & Light Company, has been wholesaling energy to the municipal electric plant at Clintonville for redistribution does not constitute an indeterminate permit, the Wisconsin Supreme Court affirmed the decision of an inferior court at Stevens Point recently handed down in favor of the Wisconsin Traction, Light, Heat & Power Company of Appleton. (See ELECTRICAL WORLD, March 27, page 682.) The Supreme Court sustained the view that an indeterminate permit is one which cannot be terminated as an ordinary contract but only by a procedure fixed by statute and designed to protect a utility company from competition. In this case the contract had been terminated according to its own specified provisions because of the acknowledged interruptions in power supply. The case was the outgrowth of failure on the part of the Central Wisconsin Power Company to carry the whole city load from Jan. 7, 1919, until June, 1925, in accordance with the terms of its contract with the city. The city considered the interrupted power service a breach of contract and took its case to the Railroad Commission, which held in March, 1925, that the contract had expired by default. The city then closed a contract with the Wisconsin Traction, Light, Heat & Power Company for service and a line was built to Clintonville.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

City May Levy Taxes on Utility Company's Stock of Appliances.—Appliances sold by a utility company to its customers are subject to taxation as personal property and cannot be classed as part of the utility company's property used in generating and distributing service, according to a decision handed down by the Wisconsin Supreme Court in favor of the Tax Commission of Milwaukee. That was the principle involved in the Milwaukee Gas Light Company's attack on this method of taxation on the ground that appliances should, under the statutes affecting utility companies, be taxed only by the state and not by the city. The company appealed to the Supreme Court from the decision of a lower court approving the action of the city Tax Commission in assessing $132,900 against the company for 1924, and $116,250 for 1925, representing ranges, heaters and other appliances on hand at the end of those years. The company argued that the appliances were sold largely for the purpose of increasing the consumption of gas as well as to promote new business activities. The city was sustained in its contention that the only property upon which the state utility tax can be levied is property actually used for generating electricity, gas and heat, and not the stock of a utility company's retail store.

Development Cost in Valuation.—The going value of a utility company as shown by the development costs, by which was meant the cost of getting customers, was held by the United States court, in Monroe Gaslight & Fuel Company vs. Michigan Public Utilities Commission, to be a clear incident of value pertinent to the replacement cost theory of fixing the rate base. The court, in speaking of the development costs, said: "Such investment is essential to put value into the plant. The early part is closely akin to interest during construction, and it would be prudent to have initial capital sufficient to use some of it for this development purpose. Whenever and to the extent that historical cost or prudent investment is to be determined, it is material to know whether this development cost has been repaid out of later profits; not so when we use reproduction value as the starting point. It is too plain for doubt that the fair present value of a plant with an established output of 80,000,000 cu.ft. is greater than that of an equivalent plant with no business. The additional value is there. Nor it is important that, if perhaps the business has been developed to the point of 'saturation' by an existing company, the hypothetical new plant would probably get the old customers with little expense. We are ultimately fixing the value of the old plant, not of the new one; we take the latter only as evidence, as far as it goes, of the former." (Fed. (2d) 319.)

Financial and Corporate

Utility Changes Small

Consolidated Gas Improves Its Position Five Points—Gains in Transactions Outnumber Losses

CONTINUED ease in the money market and improvement in the positions of certain industrial leaders such as Steel common, which during the week ended July 6 established a new high for all time, had no material effect upon the movement of the power and light stocks. Net changes in price for the week in the utility group, while small, were advances rather than declines in most instances.

On the New York Stock Exchange American Water Works & Electric Company's stock rallied another two points in sympathy with the general list. Attention was particularly attracted to the smart advance made in Consolidated Gas, which closed the week in a position more than five points above its level of the week before. Buying of Consolidated Gas appeared simultaneously with the buying in United Gas Improvement, and traders were inclined to spread rumors about future combinations in which these two important properties might play a part. U. G. I., incidentally, added about four points to its former price.

In general, the advances of the different issues did not aggregate more than about a point for the week, and in the list of stocks that gained that much may be named American Gas & Electric preferred, American Public Service preferred, Augusta-Aiken Railway & Electric preferred, Electric Investors preferred, New Orleans Public Service, Penn Ohio Securities, Philadelphia Electric, Tampa Electric and Electric Bond & Share preferred.

Montana Power Reports Best Year in Company's History

Directors of the Montana Power Company in the annual report recently issued termed the year ended Dec. 31, 1925, the best in the thirteen years of the company's life. The report covered the operations of the Great Falls Power Company, Thompson Falls Power Company, Montana Reservoir & Irrigation Company, Great Falls Water Power & Townsite Company and Deer Lodge Electric Company. The Montana Power Company owns all the stock of these companies except directors' shares.

Gross earnings for the year amounted to $8,572,241, as compared with $8,032,201 during the previous year, and operating expenses and taxes totaled $3,105,599 against $3,059,960 in 1924, leaving net earnings of $5,466,642 against $4,972,241. The increase in the gross earnings has been very generally distributed among the different sources of the company's power and lighting revenue. In 1919, before the depression of 1920 and 1921, which affected profoundly the industries of Montana, fixed property was carried on the balance sheet at $93,045,753. The balance sheet as of Dec. 31, 1925, carried that item at $96,309,340, an increase of more than three and one-quarter million dollars; current assets in 1919 amounted to $2,862,626, to $4,675,799 in 1925; surplus and reserve amounted to $5,186,939 in 1919 against $7,368,382 in 1925, a gain of $2,181,443.

The total expenditure on new construction during the year was $581,101. Of this sum the completion of Mystic Lake took $142,751; the line from Edgar to Billings, completing the connection of Mystic Lake with the rest of the system, took $62,477; various transmission-line extensions to connect new towns and customers $118,626; new substations and substation equipment, $71,315, and miscellaneous improvements and extensions, $185,931. From an operating point of view, 1925 was unusually successful. The total output of the generating plants amounted to 1,234,052,127 kw.-hr., the largest total in the history of the company, and an increase of 112,806,151 kw.-hr. over the preceding year.

Southeastern Rounds Out Big System

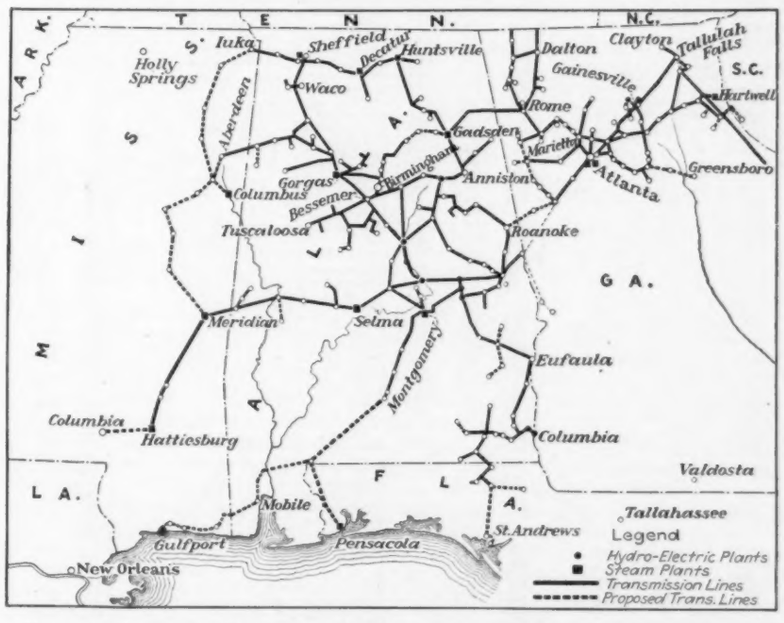
Rapidly Assimilating New Georgia Properties—Physical Operation of Systems Now Represents Joint Effort—Serves a Growing Territory

BY PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

IN THE annual report of the Southeastern Power & Light Company, just published, may be found an impressive record of growth for that utility; but the document does not contain the whole story, since several important acquisitions have been made this year. In the accompanying map for the first time is shown the enlarged Southeastern system, including the newly acquired Georgia Railway & Light properties. Even this map is incomplete, however, for Southeastern recently has purchased control of the Georgia Light, Power & Railways Company, serving the Macon district.

Thomas W. Martin and his associates have gradually extended the domain of their system until now it includes virtually the whole of Alabama, the eastern half of Mississippi, northwestern Florida and the northern half of Georgia. In a general way the Southeastern Power & Light Company would appear to have completed most of its program for extensive expansion and to have encircled most of the territory that eventually will represent the system, but on its program of intensive expansion the management has just nicely begun.

The Southeastern Power & Light



TERRITORY SERVED BY SUBSIDIARIES OF SOUTHEASTERN POWER & LIGHT COMPANY

Company's gross earnings for the year 1925 were $17,796,847, to which new high total the revenue has mounted by persistent yearly jumps from $1,460,431 only ten years ago (1916). Partly as a result of the natural growth of the territory and partly from gains made through property acquisitions, the increase has been especially marked in the last year. The 1925 total revenues of $17,796,847 were almost twice those of the year before, 1924, when gross earnings were $9,810,829. But in 1926 the gross earnings again will be nearly doubled from the 1925 sum, for in adding the Georgia Railway & Power Company to its list Southeastern added a property that was about its own size. The new properties rapidly are being assimilated by Southeastern, and already the joint operation of the systems is beginning to show substantial benefits through economies that have been made possible by the affiliation.

In a letter that accompanies the new annual report the president, in the following language, says that the territory should never suffer again from power shortage: "Co-operative development and operation of water-power resources in the various watersheds in Alabama and Georgia with large auxiliary steam plants advantageously located in Alabama coal fields will make possible a maximum utilization of power facilities in the territories served by your companies to the advantage of customers in the districts supplied and practically insuring against a recurrence of power shortage such as extended through the summer and fall of 1925."

In order to provide for the future growth of the company it will be proposed at the annual meeting on July 14 to increase the authorized amounts of the several classes of stock. Thus there will be of the seven-dollar preferred stock 750,000 shares, of the six-dollar preferred stock 250,000 shares, of the participating preferred stock 1,000,000 shares, and of the common stock 5,000,000 shares.

The gross income from all sources for the twelve months ended April 30, 1926, and including the revenues of the Georgia Railway & Power system from April 1, 1926 (the date of acquisition), was $21,556,792. It should be noted that the Georgia revenues for only one month are included in this computation. After allowance for all operating charges and fixed charges, Southeastern reported $4,313,216 as surplus against a similar figure of $3,373,623 on Dec. 31, 1925.

New Capital Issues

During the week ended July 8 the Southern Cities Utilities Company made an offering of first lien 6 per cent gold bonds, series A, to the amount of $5,500,000, the price being 100 and interest. The bonds were dated June 1, 1926, and mature June 1, 1951. The Southern Cities Utilities Company supplies electric light and power, gas, water, ice and transportation service, through subsidiaries or leased properties, to 54 communities in West Virginia, Tennessee, Pennsylvania and Alabama. In addition, the company has contracted to furnish electric light and power to 29 additional towns in Tennessee to be presently interconnected. These first lien 6 per cent gold bonds will be secured by the deposit of (a) all, but not less than $5,500,000 principal amount, of the issued and outstanding bonds, secured by a first mortgage lien on the properties of certain subsidiaries, subject to $638,000 net amount of divisional bonds to be outstanding, and (b) all of the outstanding common stock of all subsidiaries. On completion of this financing none of the owned subsidiaries will have any other bonds outstanding in the hands of the public, nor will any subsidiary be permitted to

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday July 3	Low 1926	High 1926
ABITIBI PWR. & PAPER, com.			
—no par	*k* 75¼	70¼	84¼
Adirondack Pwr. & Lt.—7% pf.	*k*106	....	....
Adirondack Pwr. & Lt.—8% pf.	*k*114	....	....
Ala. Pwr., pf.	*k*107	....	....
Allis-Chalmers Mfg. pf.	*k*108½	105	110½
Allis-Chalmers Mfg., com.	*k* 91¼	78½	94¼
Aluminum Co. of Amer., com.	*k* 74¼	54½	76
Aluminum Co. of Amer. new, pf.	*k*100	....	....
Amer. & Foreign Pwr., pf. 25% pd.	*m*108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	90	88½	98
Amer. & Foreign Pwr., com.—no par	*k* 21½	15½	42½
Amer. Bosch Magneto, com—no par	*k* 20	16	34
Amer. Brown, Boveri, Elec.	*k* 41	30½	48½
Amer. Brown, Boveri, Elec., pf.	94	86½	97½
Amer. Elec. pwr , pf.	*c*110¼	110¼	110¼
Amer. Gas & Elec., 6% pf.—no par.	94	91	94½
Amer. Gas & Elec., com.—no par.	*k* 86¼	64	99½
Amer. Lt. & Trac., 6% pf.	106½	105	115½
Amer. Lt. & Trac., com.	*k*230	195	263
Amer. Pwr. & Lt., 6% pf.	*k* 95½	92	96
Amer. Pwr. & Lt., com.—no par.	*m* 56½	50½	56½
Amer. Pub. Serv., 7% pf.—no	92	92	97½
Amer. Pub. Serv., com.	50	45	80
Amer. Pub. Utilities, 6% pf.	*k* 87	....	....
Amer. Pub. Utilities, 7% pf.	*k* 92	....	96
Amer. Pub. Utilities, com.	*k* 70	....	....
Amer. States Sec., A	*k* 3½	....	....
Amer. States Sec. B	*k* 2½	....	....
Amer. Superpwr., pf.—25	*k* 25½	23	26½
Amer. Superpower, pf.	92½	90	94
Amer. Superpwr., Class A—no par.	*k* 26½	19½	37½
Amer. Superpwr., Class B—no par.	*k* 27	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	*k*107	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	*k* 59½	43½	74
Anaconda Copper	*k* 47	41½	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	100	99	102
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	*k* 70	....	....
Arkansas Cent. Pwr., pf., $7—no par	*k*104	....	....
Arkansas Lt. & Pwr., 7% pf.	*k*101	....	....
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	*l* 106½	100½	107½
Assoc. G. & E., pf.—$3.50—50	*k* 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	*k* 84	....	....
Assoc. Gas & Elec., Class A—no par	*k*30½	25½	35½
BABCOCK & WILCOX, com.	*k*116	....	....
Binghamton Lt., Ht. & Pwr., pf.	105	105	110
Birmingham Elec. pf.—$7—no par.	*k*107	....	....
Blackstone Valley Gas & Elec., pf.	103	103	106
Blackstone Valley G.&E., com.—50	98	....	....
Blaw-Knox, com.	*m* 51	45	56
Brazilian Trac., Lt. & Pwr., com.	*f* 98½	....	....
Broad River Pwr., pf.	*k* 93	....	....
Brooklyn Edison, com.	*k*143½	133	146½
Buffalo, Niagara&East.Pwr.,pf.—25.	*k* 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par.	*k* 31½	....	....
CALIFORNIA ELEC. GENERATING, pf.	93	89	95
California Ry. & Pwr., pf.	*m*105	88	115
Carolina Pwr. & Lt., pf.—$7—no par	*k*106	....	....
Cent. & S. W. Ut. 7% pf.—no par	*a* 92½	89½	95
Cent. & S. W. Ut., pr. ln. pf.—no par	*a* 95½	93	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	98	99	99½
Central Ill. Pub. Serv., 6% pf.	88	89	91
Central Ind. Pwr., 7% pf.	87	87	93½
Central Pwr. & Lt., pf.	*k* 95	....	....
Central States Elec., 7% pf.	*k* 92	....	....
Central States Elec., com.	*m*200	200	230
Century Elec., com.	*b*116	110	116
Chicago Fuse Mfg., com., no par.	*m* 31	30½	35
Cincinnati Gas & Elec., com.	*g* 89	88	93½
Cities Service, 6% pf.	86	82½	86½
Cities Service, pf.B—10.	7	....	....
Cities Service, pf. BB—100.	*m* 74	....	....
Cities Service, com.—20.	41½	....	....
Cities Service, Bks. Shrs.—10.	20½	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	107	103	108
Cleveland Elec., Illg., com.	250	240	250
Colorado Pwr., 7% pf.	95	96	97
Columbia Gas & Elec., 7% pf.	*k*115	112	115
Columbia Gas & E., com.—no par.	*k* 84	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	65	96
Columbus Elec. & Pwr., 2d pf.	*k*103	....	....
Columbus Elec. & Pwr., com.	*k*262	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	*k* 98	....	....
Columbus Ry., Pwr. & Lt., pf. B.	*k* 94	....	....
Col. Ry., Pwr. & Lt., com.—no par.	*k* 85	....	....
Commonwealth Edison, com.	*a*143½	137½	145
Commonwealth Pwr., 6% pf.	86½	82	87½
Commonwealth Pwr., com—no par.	*k* 38½	28½	42½
Conn. Lt. & Pwr., 8% pf.	116	117	121
Conn. Lt. & Pwr., 7% pf.	107	108	120
Cons. Gas of N. Y., pf.—50.	*k* 60½	....	....
Cons. Gas of N.Y., com.—no par.	*k*103½	87	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	*e*110¼	108½	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	*e*112½	109	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	*e*127	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	*e* 51½	45	57½
Cons. Pwr. & Lt., 7% pf.	*k* 98	....	....
Consumers Pwr., 6% pf.	*k* 97½	....	....
Consumers Pwr., 6.6% pf.	*k*104½	....	....
Continental Gas & Elec., 7% pte. pf	*k*102	....	....
Continental Gas & Elec., 7% pr. pf.	*k* 98	....	....
Continental G.&E., com.—no par.	*k*130	....	....
Croker Wheeler, com.	*k* 18	....	....
Croker Wheeler, pf.	*k* 55	....	....
DALLAS PWR. & LT., 7% pf.	*k*106	....	....
Dayton Pwr. & Lt., 6% pf.	*k* 99	....	....
Detroit Edison, com.	*k*133½	123½	141½
Dubilier Condenser & Rado, com.—no par.	5½	4½	11
Dubuque Elec., 6% pf.	94	93	98½
Duquesne Lt., 7% pf.	*k*115½	111½	116½
EAST, N. Y. UTIL. pf.	93	80	85
Eastern New York Util., com.	65	70	75
Eastern States Power.	*k* 14	....	....
Eastern States Power, pf.	87	89	95
Eastern Tex. Elec., 7% pf.	*k*103	....	....
East. Tex. Elec., com.—no par.	75	70	80
Edison Elec. Illum. of Boston, com.	*d*227	207	250
E. Paso Elec., com.—no par.	70	70	94
E. Paso Elec. pf.	*k*102	....	....
Elec. Bond & Share, 6% pf.	*l* 108	103½	108½
E. Bd. & Share Sec., com.—no par.	*l* 69½	56½	86
El. Household Util.	*a* 16½	13½	25
Elec. Investors, 6% pf.—no par.	*k* 92	....	....
Elec. Investors, com.—no par.	*k* 39½	30½	74½
Elec. Investors, 10% pd. receipts	20	12	36
Elec. Pwr. & Lt., ctfs, pf.	*k* 95	89½	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	103¾	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	107	103	110½
Elec. Pwr. & Lt., ctfs., com—no par.	*k* 20½	15½	34½
Elec. Ry. Securities, com.—no par.	*m* 6	4½	10
Elec. Refrig.	*k* 75½	62½	78½
Elec. Storage Battery, com.—no par.	*k* 85½	71½	86½
Elmira Wtr., Lt. & R. R., 7% pf.	98	97½	99½
Emerson Elec., pf.	*m*103	100	104½
Empire Dist. Elec., 6% pf.	*m*87	87	87
Empire Power, A	27	21	32
Engr. Pub. Serv., pf.—no par.	93½	86	94½
Engr. Pub. Serv., com.—no par.	*k* 23	21	29½
Eureka Vac. Cleaner, com.—no par.	*k* 53½	43	53½
FAIRBANKS MORSE, pf.	111	108½	115
Fairbanks Morse, com.—no par.	*k* 50	46	59½
Federal Lt. & Trac., com.	*k* 32	28	39½
Federal Light & Traction, pf.	87	86	89
Federal Utilities, pf.	*k* 70	....	....
Federal Utilities, com.	*k* 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	*l* 108	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	*k* 42	....	....
Galveston-Hstn. El., com.	*k* 13	....	....
Gen. Elec., com.	*k*347½	285	386½
Gen. Elec., special—10	*k* 11½	11	11½
Gen. Elec., new	*k* 87	79	87½
Gen. G.&E., (Del.) com. A no par.	38	34	59
Gen. G.&E., (Del.) com. B no par.	33	28	49
Gen. G.&E., (Del.) A pf. $8 no par.	107½	105½	110½
Gen. G.&E., (Del.) A pf. $7 no par.	99	95	99½
Gen. G.&E., (Del.) pf. B.	93¼	92½	96
General Public Service, pf.	105½	90	106½
General Public Service, com.	*m* 13	12½	16½
Ga. Lt., Pwr., & Rys., 6% pf.	88	82	86½
Ga. Lt., Pwr. & Rys., com.	*m* 57½	56½	73½
Ga. Ry. & Elec., 8% pf.	*k*111	....	....
Ga. Ry. & Elec., pf.	*k*103	....	....
Ga. Ry. & Pwr., 4% pf.	125	105	145
Ga. Ry. & Pwr., com.	*k*125	....	....
Gt. Western Pwr., 7% pf.	*h*100½	....	....
HAVANA ELEC. UTIL., com.	32	28	44½
Havana Elec. Util., pf.	*m* 75	64½	75
IDAHO PWR., 7% pf.	104½	103	104
Ill. No. Utilities, 6% pf.	*a* 91	90	92
Ill. Pwr. & Lt., 7% pf.	*k* 99½	....	....
Ingersoll Rand	91	80½	104
Int. Combus. Engr., com.—no par	*k* 54½	33½	64½
Int. Utilities, class A—no par.	*k* 33½	31	39
Int. Utilities, class B—no par.	5½	4½	9½
Interstate Pwr., pf., no par.	*k* 99	....	....
Interstate Pub. Serv., 7% pf.	97	96½	99
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	*k* 96	....	....
Jersey Central Pwr. & Lt., ptc., pf.	102	95½	103
Jersey Central Pwr. & Lt., com.—no par.	45	45	50
Johns-Manville, com.—no par.	*k*164	120	165

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, July 6. *l*Bid, low, high, Wednesday, July 7. *m*Latest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday July 3	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf..	112¼	107¼	112¼
Kansas Gas & Elec., 7% pf.....	*l* 102½	99	103
Kentucky Hydro-Elec., pf.....	*a* 95	91½	95
Kentucky Sec., 6% pf.....	78	75	85
Kentucky Sec., com.....	k100	....	....
Kentucky Utilities, 6% pf.....	93	90	95
Keystone Pwr. & Lt. 7% pf.....	95	95	97
LACLEDE GAS LT., com.....	160	146	168
Lehigh Pwr. Sec., com.—no par....	*k* 15	10	23
Long Island Ltg., 7% pf.....	k109	....	....
Long Island Ltg., com.—no par....	115	120	150
Los Angeles Gas & Elec., 6% pf....	96	95¼	97
Louisville Gas & Elec., Class. A....	*k* 23½	....	....
MANHATTAN ELEC. SUPPLY..	*k* 78½	56	78½
Manila Elec., com.—no par.....	34½	27½	39½
Maytag Mfg., com.....	*k* 21	19	23½
Memphis Pwr. & Lt., pf., $7, no par	104	103	107
Metro. Edison, pf.—$6—no par.....	*k* 93½	....	....
Metropolitan Edison, pf., $7, no par.	105	102	108
Metropolitan Edison, com., no par..	45	45	50
Middle West Utilities, 7% pf.....	*a* 106	97½	111½
Middle West Utilities, 7% pr. lien pf.	*a*116	106½	123½
Middle West Utilities, com.—no par.	*a*115	108	134½
Midland Utilities, pr. ln. pf.....	*a*102½	98	104
Midland Utilities pf. A.....	*a* 99	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf..	101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf..	93	....	....
Minn. Pwr. & Lt., 7% pf.....	*l* 103	100	104
Miss. Pwr. & Lt., pf.....	k104	....	....
Miss. River Pwr., 6% pf.....	*k* 95	....	....
Miss. River Pwr., com.....	*k* 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.....	k101	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par.....	*k* 94	....	....
Mohawk Hudson Pwr., com.—no par	*k* 27	20½	28½
Montana Pwr., pf.....	*m*114½	112½	119½
Montana Pwr., com.....	*k* 78½	69½	83½
Montreal Pwr., com.....	*f* 225½	....	....
Mountain States Pwr. pf.....	*k* 95	....	....
Mountain States Pwr., com.....	*k* 20	....	....
NASSAU & SUFFLOK, LTG., pf..	*k* 98	....	....
National Carbon, pf.....	*a*126½	125	128
National Elec. Pwr., pf.....	*a* 92	92	96½
National Electric Pwr-A.....	*a* 23½	19½	26
Nat. Lt., Ht. & Pwr., com.....	24	22	25
National Lt., Ht. & Pwr., 5% pf....	72	71	73
National Pwr. & Lt., pf., $7—no par.	k100	....	....
National Pwr. & Lt., com.—no par..	*k* 23½	16½	38½
National Pub. Serv., 7% pf.....	*k* 92½	....	....
National Pub. Serv., pfc. pf.....	k100	....	....
National Pub. Serv., A com.—no par.	19½	15½	24
National Pub. Serv. B com.—no par.	*k* 14½	10	15
Nebraska Pwr., 7% pf.....	*l* 107½	103	107½
Nevada-Calif., Elec., com.....	25	18½	44½
New Brunswick Pwr., pf.....	50	30	55
New England Pub. Serv., pr. ln. pf..	97	98	99½
New England Pub. Serv., pf.....	89	95½	97
N. J. Pwr. & Lt., 7% pf.....	105	104	110
New Orleans Pub. Serv., 7% pf.....	k102	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.....	*k* 87	....	....
N. Y. Central Elec., 7% pf.....	96	98	100
Newport News & Hampton Ry., Gas & Elec., com.....	110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.....	110	109	114
Niagara Falls Pwr., 7% pf.—25....	28	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf...	108	110	111½
No. Amer., 6% pf.—50.....	*k* 51	49	51½
No. Amer., com.—10.....	*k* 51½	42	67
No. Amer. Edison pf.—no par.....	*k* 96	91½	96½
No. Amer., Lt. & Pwr., pf.....	101	88	104
No. American Utilities, pf., full pd..	*m* 94½	89	96
No. American Utilities, pf., 25% pd.	*m* 19	18	27
N.C. Pub. Serv., pf.—$7—no par...	*k* 91½	....	....
Northeastern Pwr., com.....	*k* 20	17½	36½
No. Indiana Gas & Elec., pf. A.....	102	98	103
No. N. Y. Utilities, 7% pf.....	k102½	....	....
No. Ohio Pwr., com.—no par.....	*k* 13½	11	20½
No. Ohio Trac. & Lt., 6% pf.....	78	78	81
No. Ohio Trac. & Lt., 7% pf.....	85	88	91
No. Ont. Lt. & Pwr., pf.....	*k* 83	....	....
No. Ont. Lt. & Pwr., com.....	72	45	70
No. States Pwr., 7% pf.....	k100½	99½	102½
No. States Pwr. com.....	k105	97	136½
No. Texas Elec., 6% pf.....	*k* 45	....	....
No Texas Elec., com.....	*k* 18	....	....
OHIO BRASS, com. B—no par...	74	70	79
Ohio Brass, pf.....	101	98	101
Ohio Gas & Elec., 7% pf.....	94	92	95
Ohio Pwr., 6% pf.....	95½	93	95
Ohio Pub. Serv., 6% pf.....	90	90	93
Ohio Pub. Serv., 7% pf.....	*k* 99	....	....
Ohio River Edison, pf.....	*k* 99½	....	....
Oklahoma Gas & Elec., pf.....	*k* 95	....	....
PACIFIC GAS & ELEC., 6% pf...	*k* 97	....	....
Pacific Gas & Elec. com.....	k127	118	132½
Pacific Pwr. & Lt., 7% pf.....	*l*102	98	102½
Parr Shoals Pwr., 6% pf.....	92	....	....
Penn Central Lt & Pwr., pf.—no par	*c* 72	71	91
Penn-Ohio Edison, 7% pf.....	*k* 95½	....	....
Penn-Ohio Elec., 7% pf.....	94	93	96
Penn-Ohio Pwr. & Lt., 7% pf....	96½	94	97
Penn-Ohio Pwr. & Lt., 8% pf....	107	100	106
Penn Pwr. & Lt.—$7—no par.....	*l*107	103	108
Penn Pub. Serv., 7% pf.....	101	96	100
Penn Pub. Serv., 6% pf.....	85	85	90
Penn Wtr. & Pwr., com.....	*c* 150	141	171
Phila. Co., 6% pf.—50.....	50½	47½	50½
Phila. Co., com.—50.....	71½	59½	76½
Phila. Elec., com.—25.....	*c* 52	41½	67½
Pittsburgh Utilities, pf.—10.....	17	14½	20½
Portland Elec. Pwr., 7% pf.....	*k* 97	....	....
Portland Elec. Pwr., 6% pf.....	*k* 76	....	....
Portland Elec. Pwr., 6% 2nd pf....	*k* 71	....	....
Portland Elec. Pwr., com.....	*k* 35	....	....
Potomac Elec. Pwr., pf.....	*f*108½	....	....
Pwr. Corp. of N.Y., com—no par...	*m* 79	77½	90½
Pwr. Sec., pf.—no par.....	15	19	29
Pwr. Sec., com.—no par.....	6	11	13
Pub. Serv. of N. J., 7% pf.....	k109	103½	109
Pub. Serv. of N. J., 8% pf.....	119½	115	120½
Pub. Serv. of N. J., com.—no par..	*k* 87½	72	92½
Pub. Serv. of No. Ill., 6% pf....	*a*105½	100½	105½
Public Serv. of No. Ill., 7% pf....	*a*115½	112	116½
Pub. Serv. of No. Ill., com.—no par	*a*139½	128½	140
Pub. Serv. of No. Ill., com.....	*a*139	129½	139
Pub. Serv. of Okla., 7% pf.....	94	92	95
Pub. Serv. Elec. & Gas, 6% pf....	102	97	101½
Public Service Elec. Pwr., pf.....	112	106	112
Puget Sound Pwr. & Lt., 7% pf..	k104	....	....
Puget Sound Pwr. & Lt., 6% pf..	*k* 83½	....	....
Puget Sound Pwr., & Lt., com....	*k* 29	28	66½
RADIO CORP. OF AM., pf.—50	48	44½	48
Radio Corp. of Amer., com.—no par	*k* 45½	32	48½
Republic Ry. & Lt., pf.....	k106½	....	....
Republic Ry. & Lt., com.....	*k* 85	....	....
Rochester Gas & Elec., 5% pf....	95	80	98
Rochester Gas & Elec., 6% pf....	k102	....	....
Rochester Gas & Elec., 7% pf....	105	105	107
SAN JOAQUIN LT. & PWR., 7% pf.....	97	97½	98½
Safety Cable.....	k49½	42½	54½
St. Joseph Ry., Lt., Ht. & Pwr., pf..	65	60	65
Servel Corp., Class A.....	*k* 24½	16½	25
Servel Corp., Class B—no par....	*m* 40	....	....
Sierra Pacific Elec., com.....	*k* 26½	....	....
Sioux City Gas & Elec., 7% pf....	k100	....	....
S. E. Pwr. & Lt., pf.—$7—no par..	99½	97	103
Southeastern Pwr. & Lt., ptc. pf....	65	60	67½
S. E. Pwr. & Lt., com.—no par....	*k* 26½	20	46½
So. Calif. Edison, 8% pf.....	120	135	140
So. Calif. Edison, 7% pf.....	109	110	112
So. Calif. Edison, 6% pf.....	98½	97½	99
So. Calif. Edison, com.....	*k* 31½	30½	32
Southern Cities Utilities, 7% pf....	*k* 87	....	....
Southern Cities Utilities, com.....	*k* 44½	....	....
Southwestern Lt. & Pwr., A.....	*k* 60	....	....
Southwestern Lt. & Pwr., B.....	*k* 45	....	....
Southwestern Lt. & Pwr., $6 pf....	*k* 82	....	....
Southwestern Pwr. & Lt., 7% pf....	k101	....	....
Springfield (Mo.) Ry & Lt., 7% pf.	95	....	....
Standard Gas & Elec., 8% pf.....	*k* 55	53½	57½
Standard Gas & Elec., 7% pf.....	k101	....	....
Standard Gas & Elec., com.—no par.	*k* 55½	51	60
Standard Pwr. & Lt., 7% pf.....	k102½	....	....
Staten Island Edison, pf.—$6—no par	*k* 95	....	....
Superheater, com.—no par.....	k159	132	157
Syracuse Lighting, 7% pf.....	102	105	107
Syracuse Lighting, 8% pf.....	115	....	....
Syracuse Lighting, com.....	310	260	315
TAMPA ELEC., com.....	*k* 51	48	87
Tenn. Elec. Pwr., 6% pf.....	*k* 88½	....	....
Tenn. Elec. Pwr., 7% pf.....	k102	....	....
Terre Haute, Ind. & East Trac., pf..	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.....	*l*106	102	106½
Tide Water Pwr., 8% pf.....	k102½	....	....
Timken Roller Bearing, com—no par	*k* 54½	44½	56½
Toledo Edison, 8% pf.....	113	112	114
Toledo Edison, 7% pf.....	k102	....	....
Toledo Edison, com.....	100	....	....
Tri-City Ry. & Lt., 6% pf.....	88	87½	89
UNITED GAS & ELEC., 6% pf..	*k* 94	....	....
United Gas & Elec., com.—no par..	*m* 57	56	66
United Gas & Elec. (N.J.), 5% pf....	*k* 70½	....	....
United Gas Impr.—50.....	*c*116½	84½	144½
United Lt. & Pwr., pf.—$4—no par.	48	44	51
United L. & P. pf.—$6.50—no par...	85	81	91
United Lt. & Pwr., com., A—no par	*k* 16½	12½	28
United Lt. & Pwr., com., B—no par	*m* 18½	15	31
Utah Pwr. & Lt., 7% pf.....	*l*102½	99	103½
Utica Gas & Elec., 7% pf.....	k104½	....	....
Utica Gas & Elec., com.....	200	....	....
Utilities Pwr., & Lt., 7% pf.....	*k* 92	....	....
Utilities Pwr. & Lt., com A.....	*k* 30½	28½	37
Utilities Pwr. & Lt., com. B—no par.	*k* 15	14	18
VERMONT HYDRO - ELEC., 7% pf.....	94	35	96
Virginia Elec. & Pwr., 7% pf.....	103½	101	103½
Virginia Pwr., 7% pf.....	108	102	104
Virginian Pwr., com.....	70	65	75
WAGNER ELEC., pf.....	*b* 68	65½	85
Wagner Elec., com.—no par.....	*b* 20½	20	34½
Washington Ry. & Elec., com.....	*j*180	....	....
Washington Ry. & Elec., pf.....	*j* 88½	....	....
Washington Wtr. Pwr., com.....	132	130	136
West Mo. Pwr., 7% pf.....	*k* 91	....	....
West Penn., 7% pf., temp. ctfs.....	*m*100	95½	101
West Penn, com.....	*m*125	118	130
West Penn Elec., pf.....	99½	95½	100½
West Penn Elec., Class A.....	95	88½	97
West Penn Pwr., pf.....	110½	108	112
West Va. Lt., Ht. & Pwr., 7% pf...	95	95	98
West Va. Utilities, 7% pf.—50.....	46½	43	46½
Western Pwr., 7% pf.....	93	96	98
Western States Gas & Elec., 7% pf.	*k* 90	....	....
Western States Gas & Elec., com....	*k* 16	....	....
Westinghouse El. & Mfg., com—50.	*k* 69	65	79½
Weston Elec. Instrument, Class A..	31½	27½	31½
Weston Elec. Instrument, com.....	16½	13½	19
Wheeling Elec., pf.....	90	91	93½
Wis. Pwr., Lt. & Ht., 7% pf.....	90	85	90
Worthington Pump, pf. A.....	73	68	80
Worthington Pump, pf. B.....	60	53	58
Worthington Pump, com.....	*k* 31½	20½	44½
YADKIN RIVER PWR., 7% pf...	*l*107	102	107½
Yale & Towne, com.—25.....	*k* 67	60½	69

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high. Tuesday, July 6. *l*Bid, low, high, Wednesday, July 7. *m*Latest quotations available.

issue any bonds or common stocks hereafter unless such securities are pledged under this agreement.

The agreement under which these bonds are to be issued is a part of a plan to provide a simple conservative vehicle for future financing. Proceeds of this issue and the $1,500,000 convertible 6 per cent gold debentures will be used to redeem outstanding bonds, to reimburse the company for expenditures made for additions and improvements, to provide a substantial amount of cash for completion of the present construction program and for other corporate purposes.

On Wednesday the Florida Power & Light Company offered an additional issue of first mortgage gold bonds, a piece of financing involving a total of $12,000,000. These bonds were dated Jan. 1, 1926, and mature Jan. 1, 1954, and were offered at 95 and accrued interest, to yield about 5.35 per cent. The company is controlled through ownership of all its second preferred and common stocks by the American Power & Light Company. The Electric Bond & Share Company supervises (under the direction and control of the boards of directors of the respective companies) the operations of the American Power & Light Company and the Florida Power & Light Company and of the subsidiaries of those companies. These bonds are secured by a direct first mortgage on the entire physical property of the company as of Dec. 31, 1925, and the property additions since that date against which bonds are now to be issued. The proceeds from the sale of these bonds will provide funds to reimburse the company for extensive additions to property, for the acquisition of additional properties and for other corporate purposes.

First lien 5½ per cent gold bonds of the People's Light & Power Corporation were issued to the amount of $3,500,000, the price being 94¾ and interest to yield about 6.05 per cent. The corporation, under the management of the W. B. Foshay Company, will supply, through its subsidiary properties, public utility service in Wisconsin, Minnesota, Iowa, Washington, Oregon, Arizona and Vermont. The total population of the territory served is in excess of 170,000. Sale of electricity is the main source of revenue and the electric properties are, for the greater part, hydro-electric systems. The proceeds of the sale of these bonds will be used exclusively to retire the present outstanding funded indebtedness of the constituent properties.

A new foreign loan appeared among the week's flotations. A three-million-dollar issue offered by the Mannheim and Palatinate Electric Companies (Grosskraftwerke Mannheim Aktiengesellschaft and Pfalzwerke Aktiengesellschaft) in the form of fifteen-year 7 per cent sinking-fund mortgage gold bonds. The two companies, which are jointly and severally liable upon the bonds, supply electric light and power, one to the territory in and about Mannheim in the State of Baden and the other in the neighboring Palatinate district of Bavaria. These bonds were

priced at 96½ and acrued interest to yield about 7.40 per cent.

Associated Gas & Electric Company Acquires New Properties

The election of F. S. Burroughs of Harris, Forbes & Company to membership on the finance committee of the Associated Gas & Electric Company and the recent acquisition of two additional public utility properties for the system were announced following the regular meeting of the board of directors. Mr. Burroughs was elected a director of the Associated Gas & Electric Company several weeks ago. In line with its policy of adding to its subsidiaries smaller public utility properties when they adjoin the subsidiary companies, Associated, as announced elsewhere, has taken over the White Oak Light, Heat & Power Company in western Pennsylvania. This property adjoins the property of the Penn Public System, which Associated acquired last year in its entirety. The other property which has been acquired is the plant serving Clinton, Ky., which adjoins the present properties of the Kentucky-Tennessee Light & Power Company, another Associated subsidiary group. Strength in the over-the-counter transactions in Associated securities has been accompanied by more or less gossip regarding the acquisition of additional properties for the system. Whether or not the acquisition of any large properties is to be made could not be learned.

The directors declared the regular quarterly dividends on the dividend series preferred stocks, $6 and $6.50, payable Sept. 1 to stock of record July 31; also regular quarterly dividends on the original series preferred and the seven-dollar dividend series preferred, both payable Oct. 1 to stock of record Aug. 31.

Electric Bond & Share Purchases Havana Stock—The Electric Bond & Share Company has confirmed the statement that it was the purchaser of the common stock of the Havana Electric & Utilities Company from the voting trustees, such purchase having been consummated last week at the office of the Chase National Bank of the city of New York. The price paid was $33 per share. Such purchase and sale automatically terminates the voting trust, and of the purchase price of $33 per share there will be available for distribution to the holders of voting trust certificates $31.50 per share. The Electric Bond & Share Company was already the owner of a large portion of the voting-trust certificates, as well as a substantial majority of the shares of outstanding preference stock of the Havana Electric & Utilities Company. It is understood that this purchase of all the common stock of the company, which controls the Havana Electric Railway, Light & Power Company, is the preliminary step in a rearrangement of the affairs of the operating subsidiary.

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of May:

Name of Company	Gross Earnings for May 1926	1925
Alabama Power	$1,019,467	$868,030
Baton Rouge Electric	76,623	59,175
Barcelona Trac., Lt. & Pwr.	7,155,717	6,802,421
Blackstone Valley Gas & Elec.	413,950	392,651
Brazilian Trac., Lt. & Pwr.	3,381,959	2,282,198
Cape Breton Electric	48,797	41,720
Columbus Electric & Power*	281,326	225,221
East Texas Electric (Del.)*	375,697	196,866
East Texas Electric (Del.)	419,609	198,044
Edison Elec. Illg., Brockton	134,612	128,744
Elec. Lt. & Pwr. Co. of Abington & Rockland	41,869	38,021
El Paso Electric (Del.)	234,093	212,351
Fort Worth Power & Light	226,401	223,419
Galveston-Houston Electric	394,575	342,139
Jamaica Public Service*	52,700	50,762
Key West Electric	22,937	20,925
Lowell Electric Light	128,705	118,025
Nebraska Power	345,860	328,111
Nevada-Calif. Electric	558,311	452,730
Northern Texas Electric	215,580	206,361
Pacific Power & Light	317,396	284,925
Puget Sound Power & Light	1,095,448	1,007,670
Savannah Electric & Power	177,128	151,533
Sierra Pacific Electric	100,717	95,687
Tampa Electric	405,206	250,209
Texas Power & Light	541,662	494,840
Utah Power & Light	814,673	730,863
Winnipeg Electric	439,361	411,317
York Utilities	16,210	14,611

* April.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Abitibi Power & Paper, com	$1	July 20
Allis-Chalmers Mfg., com	$1.50	Aug. 16
Bangor Hydro-Electric, com	1½	Aug. 2
Blaw-Knox, com	2	Aug. 2
Blaw-Knox, pf	1¾	Aug. 2
Cleveland Electric Illg., com	2½	July 15
Eastern N. Y. Utilities, pf	1¾	July 1
Electric Household Util	.25	July 17
Electric Household Util.*	.25	July 17
Harrisburg Lt. & Pwr., pf	1¾	June 30
International Utilities, cl. A	87½	July 15
International Utilities, pf	$1.75	Aug. 1
Kentucky Utilities, pf	1¾	July 15
Louisville Gas & Elec., 7% pf	1¾	July 15
Louisville Gas & Elec., 6% pf	1½	July 15
Milwaukee Elec Ry. & Lt., 6% pf	1½	July 31
National Electric Power, cl. A†	.45	Aug. 2
No. Boston Ltg. Properties, com	$1.12	July 15
No. Boston Ltg. Properties, pf	$1.50	July 15
Northern Indiana Gas & Elec., com.	.20	June 17
Northern Indiana Gas & Elec., pf	$1.75	July 14
Ottawa-Montreal Pwr., pf	1¾	July 15
Power Corporation of Canada	1½	July 15
Public Service of No. Ill., 6% pf	$1.50	Aug. 2
Public Service of No. Ill., 7% pf	$1.75	Aug. 2
Puget Sound Pwr. & Lt., pr. pf	$1.75	July 15
Puget Sound Pwr. & Lt., pf	$1.50	July 15
Sierra Pacific Elec., com	.50	Aug. 2
Sierra Pacific Elec., pf	1¾	Aug. 2
Southern Wisconsin Elec., pf	1¾	July 15
Superheater Company	$1.50	July 15
Superheater Company, extra	$1	July 15
Tennessee Electric Power, 6% pf	$1.50	Oct. 1
Tennessee Electric Power, 7% pf	$1.75	Oct. 1
Tennessee Electric Power, 7.2% pf.	$1.80	Oct. 1
Tennessee Electric Power, 6% pf.‡	.50	Aug. 2
Tennessee Electric Power, 6% pf.‡	.50	Sept 1
Tennessee Electric Power, 6% pf.‡	.50	Oct. 1
Tennessee Electric Power, 7.2% pf.‡	.60	Aug. 2
Tennessee Electric Power, 7.2% pf.‡	.60	Sept. 1
Tennessee Electric Power, 7.2% pf.‡	.60	Oct. 1
Tennessee Electric Power, 2d pf.‡	$1.50	Aug. 2
Tri-City Ry. & Light, com	1	July 1
Tri-City Ry. & Light, pf	1¾	July 1
Winnipeg Electric	1	Aug. 1
Yale & Towne Mfg	$1	Oct. 1

* Stock dividend. † Payable in either cash or stock at rate of one-fiftieth share of class A stock.
‡ Monthly.

Foreign Securities Sold in United States

The accompanying tabulation covers foreign electric light and power securities sold in the United States during the first half of 1926. The substantial total recorded indicates that investors are not looking with disfavor on this type of security.

SECURITY ISSUES OF FOREIGN ELECTRIC LIGHT & POWER COMPANIES SOLD IN UNITED STATES

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Northern Ontario Light & Power Co.	$5,250,000	20	First mortgage sinking-fund gold bonds	To provide funds for redemption of gold bonds	6	100	6
Sachsen-Anhalt Electric Co., of Halle (Elektrizitätswerke Sachsen-Anhalt, A. G. in Halle)	1,000,000	½–2	Serial gold coupon notes	To reduce existing loans and also in part for additional installations	6½	..	6½ to 7½
Consolidated Hydro-Electric Works of Upper Württemberg (Bezirksverband Oberschwabische Electrizitätswerke)	4,000,000	30	First mortgage sinking-fund gold bonds	Construction, additions and extensions and for the retirement of floating debt	7	93	7.60
Silesia Electric Corp. (Elektrizitätswerke Schlesien Aktiengesellschaft)	4,000,000	20	Sinking-fund mortgage gold bonds	To reimburse company for expenditures on property additions made and to be made	6½	87½	7.75
Berlin City Electric Co.	1,000,000	2	Notes	Construction	6½	99	7
(Berliner Städtische Elektrizitätswerke Aktien-Gesellschaft)	2,000,000	3	Notes	Construction	6½	98½	7
Manitoba Power Co., Ltd.	10,000,000	25	First mortgage sinking-fund gold bonds, series A	To retire bonds and for construction and additions	5½	96	5.80
Italian Public Utility Credit Institute (Instituto di Credito per le Imprese di Pubblica Utilita)	20,000,000	26	External secured sinking-fund gold bonds	Hydro-electric development and to reduce obligations contracted for such purposes	7	93	7.60
International Power Co., Ltd. (Canada)	4,000,000	—	First preferred stock	.....	7	98½	7.11
Imperial Electric Light Co., Ltd. (Japan)*	.....	.....	Bonds	.....	7½	..	..
Duke-Price Power Co.	37,000,000	40	First mortgage sinking-fund gold bonds, series A	In connection with acquisition by Aluminum Company of America	6	100	6
Stettin Public Utilities Co. (Oeffentliche Werkbetriebe der Stadt Stettin, G.m.b.H.)	3,000,000	20	First (closed) mortgage sinking-fund gold bonds	To reimburse company and its subsidiaries for expenditures made and to be made for additions to the properties	7	94½	7.55
Canada Northern Power Corp., Ltd.	2,500,000	15	Sinking-fund collateral trust bonds	To purchase controlling interest in another utility	6½	100	6.50
Total	$93,750,000						

*Not included in total. Issue amounted to 20,000,000 yen

Manufacturing and Markets

The Electrical Inspector and the Codes

How the Codes Developed and the Inspectors' Part in Formulating Them—Electrical Inspectors' Organizations and Their Objective in Promoting Code Uniformity

BY S. L. NICHOLSON
Chairman Uniform Code Committee, Electrical Manufacturers' Council

ON OCT. 19, 1881, 45 days after the first central-station company went into operation, the New York Board of Fire Underwriters issued the following notice under penalty of cancellation of insurance: "The committee on police and origin of fires is hereby directed to notify owners and occupants of all buildings in which uncovered electric wires, or in which arc lamps with open bottoms or without globes, are found that the wires must be covered and the lamps altered to conform to the rules of this board . . . within ten days from date of notice."

This was certainly not a drastic ruling. The wonder is, with such conditions actually existing, that rates on buildings with electric service were not raised to prohibitive figures or that insurance was not flatly refused. Doubtless there were those on the board who contended that this new and hazardous thing should be strangled at its birth, but more moderate counsel obviously prevailed. The manifest spirit was to co-operate with the infant industry, not to hamper it.

INSPECTION STANDARDIZES PRACTICE

In those days all interior wiring was experimental. No one knew what was good practice and what was bad. All that could be done was to install equipment according to the best judgment of the electrician in charge of the job and then keep the installation under observation to determine its weaknesses. A point which has not received the attention it deserves is that if the electrical industry had been compelled to inspect each installation from time to time, the cost of wiring would have been considerably increased and electrical progress would not have been so rapid as it was. The fire insurance companies, however, elected to do this necessary work themselves and, by instituting a system of electrical inspection, not only relieved the electrical industry of a burden of expense, but rendered it invaluable assistance in other ways.

Officially, the electrical insurance inspector was an enforcement agent, but actually his chief business was to collect facts. He studied every job of interior wiring, noted its material and method of installation, and watched it carefully for possible hazards. In particular, whenever trouble did develop he endeavored to find the exact cause and suggest some means of preventing its repetition.

Assisted by data thus accumulated, the fire insurance interests drew up rules and regulations covering electrical installations, and though these were crude and imperfect, they provided the electrical industry with definite standards of practice. Later, with the co-operation of the electrical industry and the electrical inspectors, the insurance interests drew up the National Electrical Code, which, modified and extended to meet growing needs, is one of the foundations of electrical development in America.

TWO INSPECTION SYSTEMS

For upward of twenty-five years the insurance companies alone maintained an organized system of electrical inspection, but soon after the beginning of the present century municipalities began to inspect electrical installations on their own account. This was in no way a reflection on the work of the insurance inspectors, but was due to the fact that the extending use of electricity had given rise to problems outside of the province of fire insurance. A dual system of inspection is now in force in this country, and, theoretically at least, every insured building within the limits of most municipalities must be inspected twice and covered by two certificates.

Obviously, it would be desirable to simplify this situation and consolidate these two systems into one, but this is out of the question. Neither territorially nor functionally are the two systems parallel. Municipal inspection stops at political boundaries, whereas insurance inspection obtains wherever buildings are insured; while the municipal inspector must consider a good many factors which are of only academic interest to the fire insurance inspector, and vice versa. As a matter of fact, working methods have been adopted in many localities whereby duplication of effort is reduced to a minimum and a single inspection suffices for a large proportion of the simpler electrical installations, such as those in private houses. This, however, is only practicable when both inspections are conducted under approximately the same rules and regulations, and this is one of the important considerations favoring the general use of the two national codes—the National Electrical (fire) Code and the National Electrical Safety (casualty) Code—in which are incorporated the best thought of inspectors from both fields.

> THIS is the third of a series of articles written by Mr. Nicholson at the request of the ELECTRICAL WORLD to picture in simple form the plan under which the various functions of code, test, inspection and regulation of electrical wiring installations are now organized in the electrical industry. The first subject, "The Need for a Uniform Ordinance," was treated in the ELECTRICAL WORLD of Feb. 27, and the second article, "Why There Are Two Electrical Codes," appeared in the issue of March 20. Since Mr. Nicholson has been one of the outstanding leaders in this work of organizing the procedure under which the manufacturing branch of the electrical industry is operating in the development, maintenance and application of the codes, what he writes on these subjects should be of especial interest to every electrical man.

THE UNIFORM ORDINANCE

A uniform electrical ordinance has been prepared by the Electrical Manufacturers' Council which provides that work done in accordance with the regulations as laid down in the two national codes shall be *prima facie* evidence that it is in conformity with the most approved methods of construction for safety to life and property. As the number of municipalities adopting this ordinance increases, the inspection situation will become correspondingly simplified.

This ordinance also provides for the adoption of modifications in the codes as they are made. This makes it possible to keep in step with the progress of these codes without the necessity of a detailed local study with each revision. The only subjects that need to be locally restudied from time to time are the special local rulings which can either be separately issued in bulletin form or can constitute separate articles of the local ordinance adopting the codes as its basic article.

UNIFORMITY PROTECTS INSPECTOR

When an inspector works under special codes drawn up by local authorities, he may on occasion find it difficult to justify certain of these rules because there is no nationally recognized authority behind them and nobody or precedent to guide him in their interpretation. When, however, he bases his decisions on the National Electrical Code and the National Electrical Safety Code, which are recognized American standards, he is in a far more satisfactory position. These codes are acknowledged to be the product of the best qualified opinion in America. Having been in use for so long a time, all of their provisions are clear-cut and unambiguous, and should question as to any detail of their meaning or application arise, an authoritative answer can be obtained from any of several different official sources. The use of these codes does not lessen the inspector's responsibility nor interfere with his

(*Continued on Page 97*)

High Activity Continues

Manufacturing Plants Operate Materially Above Estimated Normal During June

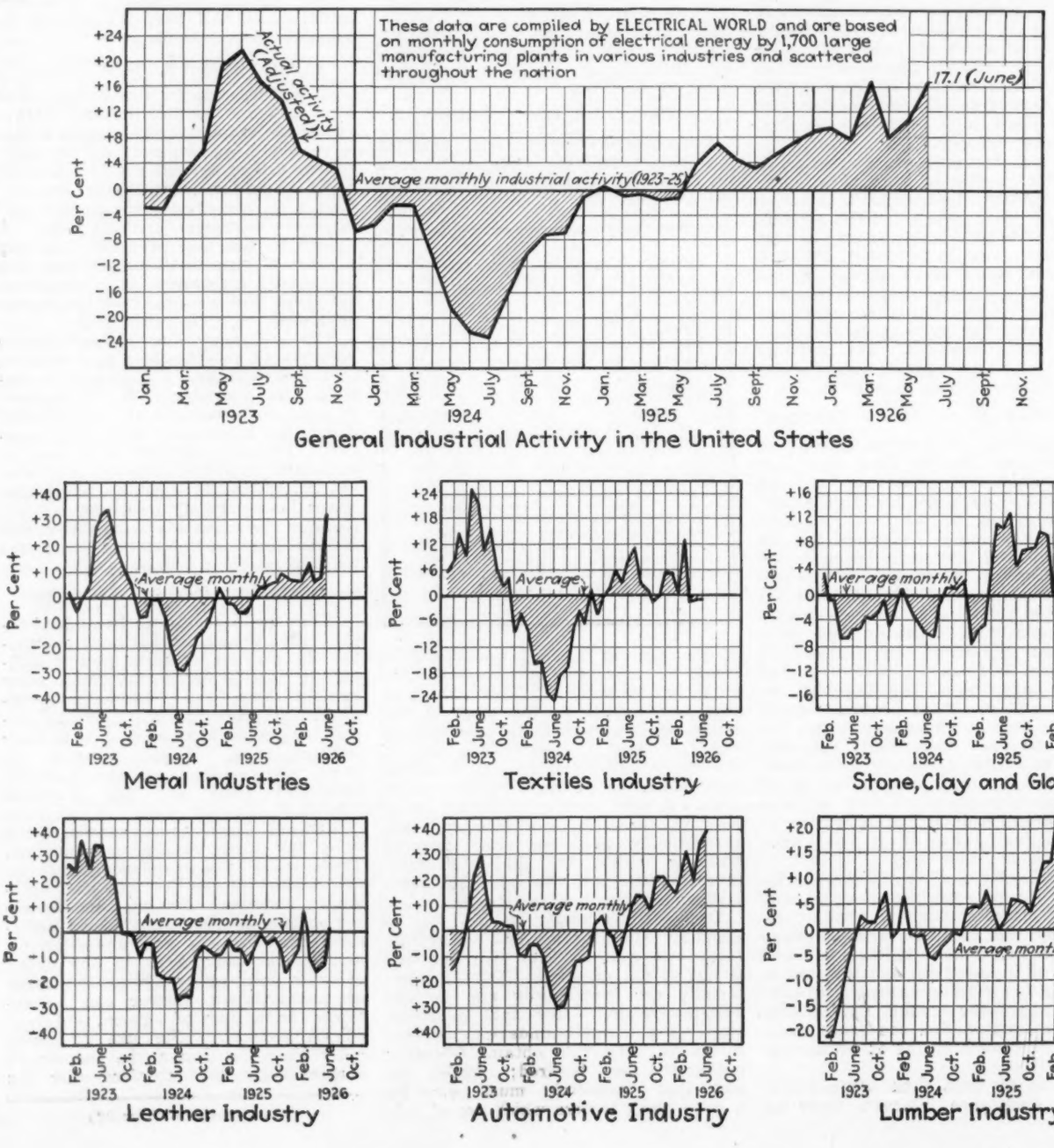
AMERICAN industry continued its onward rush of production activity during June. In spite of many predictions to the contrary, manufacturing activity failed in many instances to show the normally expected seasonal decrease, and some of the leaders actually reported a materially increased rate of activity over May. June and July are normally the low months in industrial activity, but the present year has failed to follow the past trends in seasonal activity. Not only was the June industrial activity favorable as compared with other months of this year, but it was 12.6 per cent better than the activity reported for June of last year. Such is the picture of general industrial conditions painted by the national data received by the ELECTRICAL WORLD and based upon the monthly electrical energy consumption of some 1,700 large manufacturing plants in various industries scattered throughout the nation—plants consuming about 6,000,000,000 kw.-hr. per annum.

The returns received by the ELECTRICAL WORLD indicate that during June general industrial activity in the nation as a whole was 17.1 per cent above the average monthly industrial activity for the past three years, this figure having been corrected for seasonal variation and weighted in accordance with the importance of the various industries. The fact that in June of last year general industry was operating at but 4.5 per cent above the average monthly only intensifies the prosperous condition of American industry today.

The metal industries taken as a group and for the nation as a whole reported activity during June as 31.0 per cent above the average monthly, as against 8.7 per cent in May. Although June activities are normally the lowest of the year, yet the manufacturing plants in the metal industries which have reported their energy consumption indicate a June consumption of 9 per cent over that during May. In June of last year the metal industries were operating at exactly the average monthly for the past three years.

While the rate of activity in the automotive industry during June was under that of May, yet this decrease under May was not to the extent which would normally be expected.

"Electrical World" Barometer of Industrial Activity in the United States as a Whole



The Electrical Inspector and the Codes

(*Continued from Page 95*)

freedom of action—it merely enables him to work with the best of tools.

Being in direct contact with electrical installations and a constant user of the codes, the electrical inspector (both municipal and insurance) has played an important part in their preparation and revision. He has supplied a large proportion of the data on which they are based, he has shown the need for many of their provisions, he has eliminated from them much that was undesirable, and he is constantly suggesting changes to cover either old and unnoticed or new conditions. His contribution in this respect has been highly constructive and has added materially to the public welfare. On the other hand, when he draws up special rules, which vary from city to city, the tendency is to impede the orderly development of installation practice.

There are two ways in which the inspector can assist in revising the codes —as an individual or as a member of an inspectors' organization. The committees in charge of the revision of the codes welcome constructive suggestions and criticisms from the inspectors as individuals, and to facilitate access to their knowledge and experience, the National Fire Protection Association, sponsor for the National Electrical (fire) Code, has appointed a field secretary whose business is to keep in personal touch with the inspectors and present their views to the association's electrical committee.

As a member of an organization composed of his own group, the inspector can speak with even greater authority. The electrical industry as a whole early recognized the value of organization. Almost from the very beginning the various branches of the industry, including the inspectors, formed associations, and much of the rapid progress made by electrical development has been due to collective and co-operative activity.

There are today several electrical inspectors' organizations, of which the principal are: The Eastern association, covering the north Atlantic Coast region; the Western association, covering the area between the Allegheny and the Rocky Mountains; the Northwestern association, covering Oregon, Washington and neighboring states, and the California association. Plans are also under way for the formation of an international association of electrical inspectors which will include in its membership electrical inspectors in all fields in both the United States and Canada. Through these associations greater familiarity as to the provisions of the codes is gained, preferred methods of applying the codes are agreed upon, modifications are prepared and submitted to the code committees, and representatives are sent to sit on these committees.

Code Uniformity an Objective

One of the most important services that these organizations can perform is to bring about the general use of the national codes that are American standards. Not only will uniformity in inspection benefit the inspectors directly, but it will greatly benefit the entire electrical industry — including public utilities, manufacturers, jobbers, contractors and dealers—as well as the general public. The fact that many municipalities are still using codes which are at variance with the national standards is causing loss to many and gain to none. It is increasing costs, raising prices, reducing available supplies, delaying shipments, impairing service and entailing much confusion. The electrical inspectors, especially as an organized group, are in an excellent position to understand the full measure of the economic waste thus involved and are unquestionably one of the strongest of forces that can assist in correcting this situation.

Canadian Rules to Conform to National Electrical Code

A special committee appointed by the main committee of the Canadian Engineering Standards Association convened in Ottawa, Ont., recently for a discussion of a preliminary draft of a code covering proposed rules and regulations for electrical installations in, on or over buildings using potentials of 10 volts to 5,000 volts. Considerable discussion took place as to the advisability of combining rules covering both fire hazard and personal safety, and it was the consensus of opinion that it would be advisable to combine both in one code for ease of reference and for convenience in practical use. It was considered that the Canadian code should conform, so far as possible, to the National Electrical Code, but that there were some conditions in Canada which should not be overlooked and which should be taken care of in the Canadian code. It was therefore proposed to proceed with the publication of Part 1 as soon as possible, while Part 2 (covering standards for construction, specifications and testing of electrical equipment) will be published later, as the draft of this is not complete. Representatives of the National Fire Protection Association and the National Electric Light Association reported the progress which had been made by American committees working along similar lines.

Business Conditions

MANY negotiations are reported by manufacturers as under way with central-station companies and industrial plants. Although the volume of business has receded somewhat, it is a natural trend, but in comparison with the previous year the present activity is greater. Estimates of the sales of the General Electric Company for the first half of the year indicate an increase of about 8 per cent as compared with last year. The feeling of the industry is that business will not be so good as during the first four months of the year, when sales were exceptionally heavy, but apparently there is no real falling off in inquiries yet evident either from industrial plants or central-station companies.

In the New England district sales are in steady volume with small motors in active demand and turbo-generators attracting much interest. Negotiations are under way for a number of interesting industrial installations. Industrial buying continues steady in the New York district with motors of the smaller sizes finding a ready market. Switching equipment orders have declined sharply this month, but a good demand for transformers is noted. In the Southeast business is well sustained and June sales are considered very satisfactory. Two 20,000-kw. turbine units were purchased for installation in Alabama, and motor sales continue good. An order was placed for $50,000 worth of motors for a mill installation in South Carolina. Indications point to increased business in the Middle West. Utility buying has been strong, with one large central-station company's purchases averaging over $70,000 per day, or better than $1,500,000 for the month of June. Sales are at a normal average in the St. Louis district. An order for about $80,000 was placed in that territory for switching equipment to tie in the 66,000-volt lines connecting Kentucky with Wisconsin. On the Pacific Coast central-station companies are active. Orders were placed for a 15,000-kva. condenser and four 10,000-kva. transformers, and a number of inquiries for other equipment have been received.

Copper and Zinc Firmer Despite Limited Activity—Lead Brisk

Copper and zinc prices have strengthened appreciably, although business in zinc was only moderate and in copper fair. Lead buying continues brisk. A very definite improvement in the copper market was evident on Wednesday. Inquiry was good on Tuesday, and apparently all of the metal available at 13.875 cents delivered disappeared from the market and 13.925 cents appears to be the bottom price, with some producers holding at 13.95 cents and 14 cents. The volume of business was not large but was measurably better than that of either of the two weeks immediately preceding.

The lead market continues to lead the major metals in the volume of buying. Although the domestic market has not been active, the undertone of zinc business is good and prices have

NEW YORK METAL MARKET PRICES

	June 30, 1926 Cents per Pound	July 7, 1926 Cents per Pound
Copper, electrolytic	13.85–13.875	13.925–13.95
Lead, Am. S. & R. price	8¼	8¼
Antimony	13¾	13¾
Nickel, ingot	35	35
Zinc spots	7.55	7.575
Tin, Straits	61¼	62
Aluminum, 99 per cent.	28	28

Base copper price July 7, 1926, 16 cents.

stiffened perceptibly. The tin market has been dull, but in the last day or two consumers have shown some interest.

Sales in New England District in Steady Volume

Sales in the New England district continue to show a steady trend, with small motors moving in good volume, and meters, voltage regulators and circuit breakers in good demand. Turbo-generators are also attracting much interest. Orders for large industrial equipment have declined somewhat, but negotiations are under way for a number of interesting installations and an order was placed for a 2,500-kw. turbo-generator for Maine. In connection with plant changes in favor of electrical equipment is an increasing demand for electrically driven feeder pumps and booster pumps, of which a number have been recently purchased.

Wire, cable and line hardware orders are being received in good volume, but new construction requirements for buildings have not yet matured. Street-lighting projects are being considered in a number of localities, and in particular in Quincy, where plans are underway for the installation of a "white way." Household appliance sales are spotty. One group of central-station companies reports a falling-off in sales during the past week; another reports substantial increases to date as compared with last year.

Indications Point to Increased Business in Middle West

Business is holding up well in the Middle West, and indications point to an increase during the next few months. Week-end mercantile reports indicate encouraging improvement in territorial sales, and there is apparently good business coming in from agricultural districts. The various utility companies are busy with construction work and quite a quantity of apparatus is being purchased. One large utility company's purchases averaged over $70,000 per day, or better than $1,500,000 for the month of June. Among the interesting orders placed this week were one for a 3,000-kw., 600-volt converter and a construction order for building booster pump houses valued at $40,000. A large quantity of motors and cable joints were also purchased, and pole-line hardware business is excellent.

Jobbers' sales are substantially good. There has been a good demand for wiring devices and appliances, particularly fans, irons and portable tools. Small motors are moving quite well, and there has been a good demand for hotel and restaurant equipment. There is a persistent rumor that code wire prices will follow the increased price of lead-covered wire and cable. The general average of sales in the St. Louis district is up to normal. A contract, amounting to approximately $80,000, has been awarded in St. Louis for the switching equipment required to tie in the 66,000-volt lines connecting Kentucky with Wisconsin. At present there is a great deal of interest being shown in the latest design of Diesel-electric power equipment for all service on river boats.

Industrial Buying Continues Steady in New York District

Industrial buying in the New York district continues steady, motors of the smaller sizes finding a ready market, although very little activity is in evidence among larger-sized units. Sales to public-utility companies are spotty, with no outstanding orders reported in any line. Switching equipment orders have declined sharply this month, although June sales were good. The demand for transformers is indicated by the large volume of inquiries received, and sales of distribution transformers have been particularly good. The market for cross-arms is very active, although the demand for poles is poor, owing to the absence of new construction. Meter business is excellent, particularly in the vicinity of New York City, although it is more or less scattered in the further communities.

Central-Station Companies Active on Pacific Coast

Buying by central-station companies has been active on the Pacific Coast and a number of inquiries are being received by manufacturers. An order was placed for a 15,000-kva. synchronous condenser and four 10,000-kva. transformers for use in the San Jose district. In the Puget Sound territory an order was placed for an automatic power and light feeder substation involving transformers, switching equipment, etc. The city of Seattle is said to be preparing specifications for the first of two downtown substations to be built this year, and the Great Northern Railway is in the market for approximately $300,000 worth of substation equipment. The purchase of 700 acres of land and canyon dam site will be the first steps in the construction of the Aberdeen-Washington two-million-dollar municipal hydro-electric plant on the Wynooche River, which was approved by vote on June 29. Quotations will also be requested at an early date for equipment for the Chelan Falls hydro-electric development and the twenty-million-dollar hydro-electric project on the Cowlitz River.

June contracting business was good, the decrease in volume being attributed more to cautious buying than lack of work. Railroad purchasing has been good and includes the renewal of an annual lamp contract, of not less than $100,000, which is being vigorously solicited. Street-lighting equipment amounting to $2,000 was purchased by the town of Fowler, and equipment was purchased for a small power line near Emigrant Gap.

Business Well Sustained in the Southeast

Well-sustained business is reported by all interests in the Southeast, with the June totals very satisfactory. A prominent Georgia jobber states that his June business was more than 30 per cent ahead of the same month last year, which month set a high record at that time. Considerable activity in industrial lines is to be noted, and last week turbine orders were placed for two units of 20,000 kw. each for installation in Alabama. Motor sales continue good. An order was received from South Carolina for $50,000 worth of motors for mill installations in that state.

Cable sales are normal, except for the parkway type, which is reported slow over the territory generally. A manufacturer reports the recent receipt of an order from New Orleans for $30,000 worth of submarine cable, but this is the only large single cable order received of late. Electric refrigerators are gaining steadily in popularity, and sales in the Southeast are almost 500 per cent better than in the same month last year. Refrigerating units for apartment house installation are boosting the sales totals, and contracts were recently signed for the installation of 41 units in one apartment and 27 in another in Georgia cities. Electric ranges are also being bought for apartment house installation. Central-station purchases continue in good volume. "Whiteway" equipment is in slow demand but residential and commercial lighting fixtures are selling actively, particularly in south and middle Georgia, Alabama and Mississippi.

Activities of the Trade

Electrical Testing Laboratories Enlarges Facilities

The Electrical Testing Laboratories, New York, has just concluded the purchase of a three-story building, 75 ft. x 100 ft., adjoining the laboratories at Eightieth Street and East End Avenue. The company states that it has found this expansion necessary to cope with the increased work, particularly in the field of wire, cable and transformer testing and in dielectric research work.

General Electric Sales Estimated 8 per Cent Higher for Six Months

Sales of the General Electric Company during the second quarter of 1926 are estimated at $76,000,000. Bookings during the same period last year were $66,468,000. Orders received during the first quarter of the year amounted to $86,434,000, so that the estimated total business during the first half of the year is $162,434,000, which compares with $150,314,000 for the first six months of 1925. This amounts to an increase in business for the first half of the year of approximately 8 per cent.

The Wheeler-Green Electric Company, 29 St. Paul Street, Rochester, N. Y., announces that on Aug. 1 it will engage in the wholesale business only and that its manufacturing, contracting and retail activities will be conducted by two new companies. The T. H. Green Electric Company, Inc., will take over the electrical installation, repair

and panelboard departments. The retail business will be conducted by Barber-Donovan, Inc., composed of Otis A. Barber, who has been in charge of the fixture department of the Wheeler-Green Electric Company, and George H. Donovan, formerly with the Robeson-Barber-Donovan Company.

The Pass & Seymour Company, Solvay Station, Syracuse, N. Y., has filed plans for extensions and improvements to one of its plant units.

The General Electric Company has completed plans for alterations and improvements in its Bridgeport (Conn.) plant at Boston Avenue and Bond Street.

Walker Brothers, 620 South Delaware Avenue, Philadelphia, manufacturer of underfloor steel-duct systems and fittings, have concluded negotiations for the purchase of the plant of the Philadelphia Terra Cotta Company, Spring Mill, near Conshohocken, Pa., and will occupy it at an early date.

The Westinghouse Electric & Manufacturing Company has taken over a building on Cleveland Avenue, Fairmont, W. Va., and will establish a new factory branch at this location for service and repair divisions.

The Burke Electric Company, Erie, Pa., manufacturer of direct and alternating current machinery, announces the appointment of C. A. Cotton, 135 High Street, Boston, as district sales agent for the New England territory.

The Westinghouse Electric & Manufacturing Company has received an order from McClelland - Junkersfeld, Inc., for equipment for the third section of the Union Electric Light & Power Company's Cahokia station. The order, amounting to approximately $200,000, calls for oil circuit breakers and associated control equipment.

The Dayton Fan & Motor Company, Dayton, Ohio, manufacturer of "Day-Fan" motors, fans and radio apparatus, announces that, effective July 15, the name of the company will be changed to the Day-Fan Electric Company with no change in its organization or personnel. The company has recently purchased a new ten-acre modern plant at Miami Chapel Road and Wisconsin Boulevard.

The American Electrical Works, Phillipsdale, R. I., manufacturer of bare and insulated wires and cables, has completed plans for two one-story additions to its plant to be used for general operating and office service. One of these will be 52 ft. x 110 ft. and the other 22 ft. x 54 ft.

The Killark Electric Manufacturing Company, 3940 Easton Avenue, St. Louis, manufacturer of "Electrolet" conduit fittings and bell transformers, has moved into its new factory building, which has just been completed. The present building, which has approximately 25,000 sq.ft. of floor space, is of reinforced-concrete construction and replaces the old one, which was destroyed by fire in September, 1925.

The General Electric Company announces that H. D. Randall has been made sales manager of the gear section of the industrial department, with headquarters at the River Works, West Lynn, Mass.

The American Pulverizer Company, Eighteenth and Austin Streets, St. Louis, manufacturer of coal crushers, pulverizers and shredders, announces the appointment of A. M. Lockett & Company, Queen and Crescent Building, New Orleans, as its representative in Louisiana and southern Mississippi. The company has also appointed the Titzel Engineering & Equipment Company, 30 East General Robinson Street, Pittsburgh, as its representative in western Pennsylvania, West Virginia and western Virginia.

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission switching and protective equipment, announces that R. R. Stevenson will be associated with its New York and Philadelphia offices in the consulting capacity of sales engineer. Mr. Stevenson was formerly chief engineer for the Electrical Development & Machine Company.

The American Electric Porcelain Company, Trenton, N. J., has been organized with a capital of $100,000, to take over and operate the plant of the United States Electric Porcelain Company, Princeton Avenue, recently secured by officials of the new company at a receiver's sale. Plans are under way for improvements and the immediate resumption of production for the manufacture of a line of electrical porcelain specialties.

New Equipment Available

Frequency Changer

A single-unit frequency changer using a single magnetic core has been developed by Forbes & Myers, 172 Union Street, Worcester, Mass. In this machine the two windings are placed in the same slots, one winding driving the machine and the other performing the function of frequency conversion. The unit is available in ½-kva. capacity to convert from 60 cycles to 240 cycles, but similar machines will be built up to 3 kva. capacity, which is large enough to drive a 2-hp. motor at 14,000 r.p.m. The frequency changer will be built for any desired frequency, but as the company manufactures induction motors to operate directly from 60-cycle current at speeds of 5,400 r.p.m. and 7,200 r.p.m. it is not expected that there will be any demand for frequencies under 180 cycles.

Method of Impregnating Poles and Wooden Construction

A method of impregnating poles and wooden construction known as the Furnos method has been developed by A. B. Furnos, Stockholm, Sweden. The treatment, which can be readily applied, is adaptable to poles already erected as well as to new poles. The pole to be treated is uncovered and cleaned and decayed parts are removed with a scraper. Then, using the Furnos pole burner, by means of which a temperature of about 2,350 deg. F. is obtained, the pole is burnt to about 2 ft. above the ground level. The burning is performed in a way to obtain a layer of charcoal about ¼ in. thick. On account of the intense heat a large number of small cracks ensue, and in this way the mechanical strains of the wood are released and it is said that subsequent desiccation cannot originate further cracks. While the pole is yet hot it is liberally treated with creosote oil by means of the Furnos impregnating apparatus. As the cooled creosote oil is brought to the wood, the remaining small quantity of air contracts and produces a vacuum which causes the oil to penetrate deeply into the pole.

Although the burning of the wood produces a layer of charcoal, which by itself protects the wood as far as the surface is concerned, the direct preserving qualities of the charcoal are only of secondary importance. The principal function of the charcoal is to bring about a subsequent impregnation. The charcoal, being very porous, absorbs a considerable quantity of the creosote oil after the wood has taken up all that it can and this excess oil held by the charcoal is gradually given up to the wood. The operation can be performed irrespective of weather conditions as the heat drives away all moisture in the form of vapor.

Sidewalk Guy

An improved sidewalk guy for a pole where conditions would make it necessary to stretch a guy wire across a sidewalk or where the ground area is limited, requiring a trussed type of guying, is being offered by the Line Material Company, South Milwaukee, Wis. The guy uses a horizontal pipe with a pole plate on one end and an end casting on the other. It is installed in the same manner as an ordinary head guy; that is, the strain insulator is cut into the guy wire on the ground and the end casting is attached. The guy wire is then fastened in the ordinary manner by the lineman on the pole. The pole plate is not lagged to the pole until the guy has been finally tightened, when it is raised or lowered until horizontal. The guy is then pulled taut on the ground at the anchor, the same as in the installation of an ordinary head guy.

Live-Line Clamp

The "Iler" live-line clamp, which has a carrying capacity of more than two times the largest-size wire on which it can be used and is so constructed that it can be clamped to either wire, flat busbar or structural-steel members, is being marketed by the Railway & Industrial Engineering Company, Greensburg, Pa. It is said that for every inch-pound exerted on the switch stick when screwing the clamp there is a pressure of 40 lb. exerted on the clamped member and that this high pressure overcomes faulty contact due to corrosion. There are no springs to fuse or corrode and no soldering is necessary with this clamp.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Milan, Italy (No. 21,018), for radio sets and parts; for radio sets and parts (No. 21,019); also for radio sets of four or five tubes and parts (No. 21,017).

An agency is desired in Melbourne, Australia (No. 21,016), for vacuum cleaners.

Purchase and agency are desired in Amsterdam, Netherlands (No. 21,103), for washing machines, ironers and flatirons.

Purchase is desired in Montevideo, Uruguay (No. 21,077), of iron supports for transmission poles.

New Trade Literature

AUTOMATIC PUMPING. — Barrett, Haentjens & Company, Hazleton, Pa., have issued a booklet entitled "Automatic Pumping," in which are described several new methods of automatically operating centrifugal pumps. Two elementary wiring diagrams for automatic pump control where a priming pump is used is included.

POINTER GAGES.—The Hays Corporation, Michigan City, Ind., has issued a new catalog covering the Hays pointer-type draft and pressure gages. Instructions for installing the Hays gages and a description of the operating mechanism are included.

FLEXIBLE COUPLING.—Bulletin No. 108 issued by the Poole Engineering & Machine Company, Baltimore, describes the Poole all-metal flexible coupling. It contains an illustration showing the details of the flexible coupling and also a table giving the horsepower ratings and dimensions of the various sizes.

EDGE-WOUND RESISTORS. — The Clark Controller Company, 1146 East 152d Street, Cleveland, is distributing bulletin No. 104, in which it describes and illustrates the "Monitor" edge-wound resistors designed to suit all requirements of space or service. Illustrations showing resistor sections and a bank of ten "Monitor" edge-wound resistor units, illustrating tap and bridging terminal clamps, and a table of sizes, ratings, etc., are included.

INDUCTION MOTORS.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-405 and GEA-435, covering respectively its constant-speed induction motors and its multi-speed induction motors for elevator service.

TRANSFORMER TAP CHANGER.—Bulletin No. 2,055 issued by the Pittsburgh Transformer Company, Pittsburgh, describes and illustrates by means of photographs and drawings the construction and operation of the Pittsburgh transformer tap changer.

EXPLOSION CHAMBERS FOR OIL CIRCUIT BREAKERS.—Bulletin GEA-372 issued by the General Electric Company, Schenectady, N. Y., covers its explosion chambers for high-voltage oil circuit breakers. It contains a description of the details of construction and operation of the explosion chambers. A line drawing showing the oil-circuit-breaker mounting and construction of the explosion chamber is included. Attention is also called to some of the advantages obtained by the use of the explosion chambers.

GROUND WIRES. — The Copperweld Steel Company, Braddock Post Office, Rankin, Pa., is distributing a leaflet containing engineering notes on "Aristos" Copperweld wire for non-rusting overhead ground wires. The company is also distributing a long-span data form for engineering correspondence on Copperweld conductors.

DISTRIBUTION TRANSFORMERS. — Leaflet L20288 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates the application, construction and distinctive features of the Westinghouse shovel-type distribution transformer, with leak-proof bushings and tanks.

GENERATORS.—Bulletin No. 601 issued by the Engberg's Electric & Mechanical Works, 158 Vine Street, St. Joseph, Mich., describes and illustrates the Engberg direct-current and alternating-current generators and their application to internal-combustion engines. Capacity and dimensions tables of its various types of generators are given. The company is also distributing bulletin No. 801, covering the Engberg alternating-current generating sets. Line drawings showing sectional parts of both engine and generator are included.

ELECTRIC VENTILATION.—The American Blower Company, Detroit, has issued a bulletin on electric ventilation containing instructions and suggestions to electrical dealers regarding the creation of a market for ventilating fans. Illustrations showing typical installations of American Blower fans and instructions for installing American Blower fans in various business places are given. The company is also distributing a booklet describing its selling program, magazine advertising, selling helps, newspaper advertising, sales plans, etc.

UTILITY SWITCHES.—The Johns-Pratt Company, Division of Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., is distributing a leaflet describing the three general utility switches added to its "Noark" line.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME.—The Central Maine Power Company has applied for permission to issue $5,500,000 in bonds and $1,500,000 in capital stock. Of the bond issue it is proposed to use $2,500,000 for new construction, to include the erection of a 33,000-volt transmission line between Augusta and Rockland, to cost $500,000; new office building in Augusta, $200,000, transmission lines to Lewiston and rural line extension, $150,000.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston is contemplating adding a 60,000-kw. steam turbine unit to its Edgar Station in the near future.

FRANKLIN, MASS.—Plans are under way by the Union Electric Light & Power Company for rebuilding the 11-kv. transmission line supplying the Mansfield plant from the Blackstone substation for 22-kv. service. New street-lighting service is planned for the Mansfield and Franklin district.

MALDEN, MASS.—Bids are being received by the Malden Electric Company for the construction of a repair shop and garage to cost about $75,000.

WORCESTER, MASS.—Plans have been filed by the Worcester Electric Light Company for the installation of a water-conditioning plant for power station service at 58 Webster Street, to cost about $25,000.

NEW HAVEN, CONN.—A permit has been granted the Connecticut Company for the erection of an addition to its power house at 450 Grand Avenue, to cost about $45,000.

Middle Atlantic States

ALBANY, N. Y.—Electric power equipment will be installed in the proposed printing plant to be erected on Sheridan Street, by the Argus Printing Company, Argus Building, to cost about $180,000. Walter E. Timmis, 315 Fifth Avenue, New York, is architect.

FRANKFORT, N. Y.—Negotiations are under way by the village authorities and the Utica (N. Y.) Gas & Electric Corporation for bringing a new feeder line into Frankfort.

JAMESTOWN, N. Y.—The Art Metal Construction Company plans to install electric power equipment in its proposed addition, to cost about $200,000.

LONG ISLAND CITY, N. Y.—Electric power equipment will be installed in the proposed warehouse and distributing plant to be erected on Hunters Point Avenue by the Manhattan Coffee & Sugar Company, Hulst Avenue, to cost about $150,000.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has applied for permission to erect a transmission line in the towns of Chester and Warwick to make connection between its substation at East Walden and the transmission line of the New York-New Jersey Power & Light Corporation at the state line.

RENSSELAER, N. Y.—The Council has authorized the Eastern New York Utilities Corporation to install an ornamental lighting system in the principal streets, at a cost of about $14,500.

SPECULATOR, N. Y.—Application has been made to the Public Service Commission by the Trustees of the Village of Speculator for permission to operate an electric-light system in the village. It is proposed to build a hydro-electric plant.

BAYONNE, N. J.—The Tide Water Oil Company, 11 Broadway, New York, will install electric power equipment in connection with extension at its local refinery, to cost about $5,000,000.

HALEDON, N. J.—The Borough Council has approved plans for the installation of a fire-alarm system.

BATH, PA.—The Keystone Portland Cement Company, care of E. J. Fox, Easton Trust Company Building, Easton, recently organized, plans to install electric power equipment in its proposed local cement mill, to cost about $500,000.

PHILADELPHIA, Pa.—Electric power equipment will be installed in the addition to the plant of the Edward G. Budd Manufacturing Company, Twenty-fifth Street and Hunting Park Avenue, to cost about $600,000.

PHILADELPHIA, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 28 for furnishing and installing furniture lighting in the United States post office and court house in Philadelphia. For details see Searchlight Section.

PINE GROVE, PA.—The Eastern Pennsylvania Light, Heat & Power Company, Pottsville, plans to install a coal-pulverizing plant in connection with extensions at its local electric station.

PITTSBURGH, PA.—Extensions are contemplated by the West Penn Power Company during the next eighteen months, including a water power development of 67,000-kva., and the installation of a 47,000-kva. generator at the Springdale plant, and will also complete 28 miles of steel tower line and 75 miles of wood pole transmission line.

WEST HAZLETON, PA. — The City Council is considering extensions and improvements in the street-lighting system in connection with a ten-year contract made with the Pennsylvania Power & Light Company, Allentown, for furnishing electric service.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company plans to install an underground conduit system in the Homewood, Liberty, Wolfe and Tuxedo districts, totaling about 7½ miles.

HUNTINGTON, W. VA.—The Owens Bottle Company, Nicholas Building, Toledo, Ohio, plans to install electric power equipment in proposed additions to its local plant, to cost about $500,000.

ROANOKE, VA.—Work will begin at once by the Norfolk & Western Railway Company on improvements to its railroad between Roanoke and Winston-Salem, N. C., which will include automatic block signals, a 4,400-volt transmission line, electrical equipment, etc. The cost of the equipment is estimated at $1,200,000.

SOUTH BOSTON, VA.—The Southside Virginia Power Company has applied to the Federal Power Commission for a preliminary permit for a 20,000-hp. hydro-electric development near Talley's Falls on the Roanoke River in Mecklenburg, Charlotte and Halifax Counties.

WEYER'S CAVE, VA.—The Shenandoah River Power Company plans extensions in its transmission lines in Page and Rockingham Counties.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Washington, until July 15, for 130 insulators (Circular C. P. 24044-A-10).

WASHINGTON, D. C.—Bids will be received by the Supervising Architect, Treasury Department, Washington, until July 12, for exterior lighting fixtures for federal buildings.

WASHINGTON, D. C.—Bids will be received by the Purchasing Agent, Post Office Department, Washington, until July 14, for 10,500 batteries. Also, until July 12, for 20 lamp changers.

North Central States

DEARBORN, MICH.—The United States Gypsum Company, 205 West Monroe Street, Chicago, plans to install electric power equipment in its proposed local mill, to cost about $350,000.

GRAND RAPIDS, MICH.—The Pere Marquette River Company, care of Charles

Owen, Grand Rapids, recently organized, has applied for permission to construct a hydroelectric power plant on the Pere Marquette River, to cost about $350,000. A transmission line will be built.

MERCER, MICH.—The Village Council has awarded a contract for the installation of a street-lighting system. Connection will be made with the Big Falls line of the Lake Superior District Power Company, Ironwood, for electric service.

CANTON, OHIO.—The Ohio Public Service Company is considering the erection of a 132,000-volt transmission line (71 miles long) between Ashland and Canton.

CINCINNATI, OHIO. — The Chevrolet Motor Company, Detroit, plans to install electric power equipment in its proposed plant addition, to cost about $400,000. Albert Kahn, Inc., Marquette Building, Detroit, is architect.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until July 16 for series multiple transformers for the Division of Light and Power.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has acquired the right of way of the defunct Cleveland, Painesville & Easton Railroad on which it will erect a high-tension transmission line between Ashtabula and Conneaut, which will serve electricity from the Avon generating station to the above named towns and intervening communities.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company contemplates the erection of a 132,000-volt transmission line from Cleveland to Conneaut, a distance of 70 miles. Electricity will be supplied to towns along the route. Short tie lines of same voltage will be built in the immediate vicinity of Cleveland, including one to connect the Lake Shore and Avon stations of the company.

COLUMBUS, OHIO—Arrangements have been made between the Columbus Railway, Power & Light Company and the United Ohio Utilities Company, recently organized, whereby the former will connect with the power lines of the latter. Plans are under way for the erection of a high-tension transmission line into Chillicothe. It is also announced that the Chillicothe lines will be extended to the new Pickaway power station of the Columbus Railway, Power & Light Company, 10 miles south of Columbus.

EAST LIVERPOOL, OHIO.—Bids, it is understood, will soon be asked by the Ohio Power Company, Canton, for the construction of a local substation, the equipment to include a 2,000-kw. transformer, etc.

WASHINGTON, C. H., OHIO.—Arrangements have been made with the Dayton (Ohio) Power & Light Company for the installation of an ornamental lighting system on Court Street, from Main to Fayette Street.

YOUNGSTOWN, OHIO.—The Pennsylvania-Ohio Power & Light Company plans to erect 50 miles of 66,000-volt, steel tower transmission line.

LEXINGTON, KY.—Plans are under consideration by the Kentucky Utilities Company, Inc., to raise the voltage on about 100 miles of transmission line from 33 kv. and 66 kv. to 132 kv. and interconnect with other systems in Indiana.

FORT WAYNE, IND.—Improvements are contemplated to the municipal electric light plant, to cost about $75,000. The work will include new coal bunkers, storage bins and coal hoist.

WEST BADEN, IND.—The Interstate Public Service Company, Indianapolis, plans to extend its transmission line to French Lick, Loogootee and vicinity.

GRAYVILLE, ILL.—The City Council has granted the Central Illinois Public Service Company, Springfield, permission to furnish electric service in Grayville and also a contract for street-lighting for a period of twenty years.

HIGHLAND, ILL.—Bids, it is understood, will soon be asked on improvements to the municipal electric plant, to cost about $50,000. The project will include either one 600-kw. or two 300-kw. generating units, condensing apparatus, chain-grate stoker, coal elevating apparatus, etc. The W. A. Fuller Company, 1917 Railway Exchange Building, St. Louis, is engineer.

PARIS, ILL.—At a recent election the proposal to install 150 street lamp standards was carried. The lamps will be maintained by underground wires.

SAVOY, ILL. — Permission has been granted the Central Illinois Public Service Company, Springfield, to erect a high-tension transmission line from Tolono to Savoy, a distance of about 4 miles. Electricity will be supplied to farmers along the line. The cost is estimated at about $20,000.

ASHLAND, WIS.—Plans for the proposed local steel mill to be erected by the Cubine Company, include a power plant.

EAGLE RIVER, WIS.—Plans have been adopted by the Village Board for the installation of auxiliary power equipment at the municipal light and water plant to supplement the water power; and also for increasing the voltage of the transmission line to Minocqua from 6,000 to 13,200 volts.

KIEL, WIS.—Arrangements have been made between the Wisconsin Public Service Corporation, Green Bay, and the Village Council whereby the former will supply electricity for the municipal electric light and water plant after Oct. 1. A transmission line will be erected to connect the two systems.

MADISON, WIS.—If sufficient signatures can be secured from resort owners for electric service, the Wisconsin Power & Light Company will erect a transmission line (7 miles) along the north shore of Fox Lake.

RIPON, WIS.—Plans have been approved by the Wisconsin Power & Light Company, Madison, for the erection of a new 13,200-volt transmission line from Fairwater to Brandon.

WYALUSING, WIS.—The Village Board has accepted the proposal of the Interstate Power Company, Chicago, to supply electricity in Wyalusing. The company will extend its transmission line here to furnish the service.

MINNEAPOLIS, MINN.—The Interstate Power Company, Chicago, is said to be planning extensions in the transmission lines of the Minnesota Electric Distributing Company, recently acquired.

ST. PAUL, MINN.—The City Bureau of Lighting is considering the installation of an ornamental lighting system on streets in the district bounded by Eighth, St. Peter and Third Streets, and Broadway, using two-lamp standards.

WINTHROP, MINN.—The Eagle City Cordage Company is planning to rebuild its power plant recently damaged by fire.

DAVENPORT, IOWA.—The Dewey Portland Cement Company, Kansas City, Mo., plans to install electric power equipment in its proposed local plant to cost about $500,000.

MANCHESTER, IOWA.—Improvements to the lighting system in the business district is under consideration by the City Council.

ST. LOUIS, MO.—Plans are under way for extensive improvements in Kingshighway Hills, a 100-acre tract located on Southway Boulevard, south of Tower Grove Park. The work will include street improvements, curbing, sewers, gas, water, electric system, street lighting, etc., all to be done under the supervision of the Board of Public Service of St. Louis.

SPRINGFIELD, MO.—Contract has been awarded for the installation of an ornamental lighting system on McDaniel Street, from Campbell Avenue to Kimbrough Avenue to the Springfield Gas & Electric Company, to cost about $10,000.

BRINSMADE, N. D.—The City Council is planning the erection of a substation for local light and power service.

CHAMBERLAIN, S. D.—Surveys are being made by the Dakota Public Service Company, Sioux City, Iowa, for the erection of a high-tension line between Chamberlain and Kimball. The line will eventually be extended to Mount Vernon.

HAIGLER, NEB.—The local electric plant, owned by W. F. Wood, was recently destroyed by fire, causing a loss of about $35,000.

HARTINGTON, NEB.—The City Council has granted the Hartington Electric Light Company a franchise to supply electricity here. The company plans to build a power station and an electric distribution system in Hartington.

WAHOO, NEB.—The City Council has rejected all bids submitted for equipment for the municipal electric power plant, and will ask for new bids at once. The apparatus will include a 250-hp. water-tube boiler, underfeed forced-draft stoker, feedwater heater, pumping equipment, etc.

Southern States

DURHAM, N. C.—Plans are under consideration by the Liggett & Myers Tobacco Company, 4241 Folsom Street, St. Louis, for the construction of a power plant at the corner of Fuller and Randolph Streets to cost about $200,000. Lockwood, Greene & Company, 1 Pershing Square, New York, are engineers.

RURAL HALL, N. C.—The Southern Public Utilities Company, Winston-Salem, plans to install an improved street-lighting system here.

WILMINGTON, N. C.—The Tide Water Power Company, Wilmington, plans to build a transmission line to White Lake and vicinity for general commercial service.

ALBANY, GA.—The City Council is considering a bond issue of $30,000, for extensions and improvements in the street-lighting system.

JESSUP, GA.—The Ware County Light & Power Company, Waycross, which has acquired the municipal electric lighting plant, plans extension to its transmission lines in this section.

SPARTA, GA. — The Georgia Southern Power Company, Dublin, contemplates extending its transmission line from Tennille to Sparta, Jewell and vicinity.

SANFORD, FLA.—The Florida Power & Light Company, Miami, plans to erect a 66,000-volt transmission line from Fort Sewell to Sanford a distance of about 100 miles, and also a line from Fort Pierce to Arcadia, to cost with substations about $1,500,000.

TAMPA, FLA.—Plans for the proposed local cement works to be erected by the Florida Portland Cement Company to cost about $4,000,000, include a power plant. Charles McKeand, Tampa, assistant to the president, is in charge.

KINGSPORT, TENN.—The Board of Public Works is considering extensions in the ornamental lighting system in the downtown district.

McKENZIE, TENN. — Permission has been granted the Kentucky-Tennessee Light & Power Company, Bowling Green, to purchase the municipal electric light plant.

SILVERHILL, ALA.—A permit has been granted the Silverhill Power Company for the construction of a hydroelectric plant on the Fish River, to cost about $250,000.

HEIDELBERG, MISS.—Plans are under consideration by the City Council for the construction of a municipal electric plant, waterworks and ice-factory, to cost about $75,000.

PASCAGOULA, MISS. — The Louisiana Ice & Utilities, Inc., a subsidiary of the Commonwealth Utilities Corporation, St. Louis, contemplates improvements to the ice manufacturing plants at Gulfport, Biloxi and Pascagoula, and the refrigerating station at Moss Point, to be operated in conjunction with the Pascagoula plant.

FOREMAN, ARK.—The Dierks (Ark.) Lumber & Coal Company, which has purchased the local electric plant, plans to erect a high-tension transmission line from Dequeen to Foreman to furnish electric service here. The company also contemplates building a line from Idabel through Haworth to Foreman. The Dierks company has three 2,000-hp. plants, one located at Dierks, one at Broken Bow and the other at Wright City.

NEWPORT, ARK.—The local plant of the Arkansas Light & Power Company, Pine Bluff, was recently damaged by fire, causing a loss of about $15,000.

PANGBURN, ARK.—Plans are under way by the E. K. Stanfield Company, Home Life Building, Little Rock, for a hydroelectric development on Big Creek. The project includes the erection of a transmission line from Heber Springs to Pangburn, Higginson and Des Arc.

BASTROP, LA.—The Louisiana Pulp & Paper Company plans to install electric power equipment in the addition to its pulp mill, to cost about $850,000.

MARINGOUIN, LA.—The City Council is planning to build a municipal electric plant and waterworks system. F. P. Joseph, Glenmora, is engineer.

MINDEN, LA.—The Shreveport Mineral Corporation, Shreveport, is considering the installation of an electric power plant at its proposed local salt mill. J. J. Kean is in charge.

HODGEN, OKLA.—The Oklahoma Gas & Electric Company, Oklahoma City, plans to erect a transmission line from Heavener to Hodgen, a distance of 4 miles, to furnish electrical service here.

McALESTER, OKLA.—The Southwest Power Company has submitted a proposal to the City Council for the installation of a new ornamental lighting system in the downtown section. The plans provide for seventy-two concrete posts mounted with 300-cp. lamps, to cost about $15,000.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company plans to install an underground conduit system in part of the business district, to cost about $30,000.

ABILENE, TEX.—The West Texas Utili-

ties Company, is considering extensions in its transmission line for service at Putnam, Moran, Albany and vicinity.

DONNA, TEX.—Plans are being prepared by the Val Verde Mercantile Corporation for the construction of a canning and refrigerating plant, to cost about $500,000.

Pacific and Mountain States

BREMERTON, WASH.—Work will begin at once on the construction of the first unit and extensions of the local plant of the Puget Sound Power & Light Company, Seattle. The work will include an addition to the Fourth Street Building, recently purchased, construction of a large warehouse and garage building.

SEATTLE, WASH.—The Department of Lighting is planning to build a substation and office building, to cost about $1,000,000, in the downtown section. The cost of the substation with equipment is estimated at $650,000.

TACOMA, WASH.—The City Light Department has rejected all bids submitted for a substation to be erected at North Sixth and Third Streets. Bids, it is stated, will be asked later on revised specifications.

PORTLAND, ORE. — Application has been filed with the State Engineer, Salem, by T. A. Sweeney, Portland, to appropriate water rights from the Umpqua River for a 10,000-hp. hydro-electric development, to cost about $700,000.

LONG BEACH, CAL.—Bids will be received by the Board of Education until July 12, for a switchboard for the Woodrow Wilson High School.

LOS ANGELES, CAL.—Preliminary surveys are being made by the Santa Fe Railroad Company for the electrification of its railroad from Los Angeles to Bakersfield, to cost about $800,000.

LOS ANGELES, CAL.—The City Council has adopted ordinances providing for the installation of ornamental lamps on Ninth Street, Exposition Boulevard, and San Vicente Boulevard, using concrete standards.

LOS ANGELES, CAL.—Bids will be received by the Board of County Supervisors, Court House, until July 12, for the installation of ornamental lamps on Clinton and other streets and on streets in County Tract 6954, using cast iron standards.

PITTSBURG, CAL.—The City Council is considering a petition for the installation of ornamental lamps on Third Street.

RIVERSIDE, CAL.—The City Council has adopted a resolution providing for the installation of ornamental lamps on portions of New Magnolia Avenue, Fourteenth Street, Market and other streets in the business section.

SAN BERNARDINO, CAL.—The City Council is considering a petition for the installation of ornamental lamps on the Base Line, between Sierra Way and I Street, and on Highland Avenue.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has filed plans for the erection of a substation in East San Diego, to cost $325,000.

SAN JACINTO, CAL.—The City Council is considering the installation of ornamental lamps on a number of blocks in the downtown district, using metal standards.

KELLOGG, IDAHO.—The Sullivan Mining Company plans to install electric power equipment in its proposed zinc smelting plant, to cost about $1,000,000.

Canada

POINT GREY, B. C.—A by-law requesting a standard street-lighting system in Kerrisdale, to cost about $70,000, has been introduced in the Point Grey Council.

WINNIPEG, MAN.—The City Council is considering the installation of ornamental lamps on Memorial Boulevard, and Osborne Street to cost $34,000 and $25,000 respectively.

ORILLA, ONT.—The Orilla Water, Light and Power Commission is considering changing the municipal electric distribution system from two phase, four wire, 2,200 volts to three phase, four wire, 8,810 volts. The cost is estimated at about $30,000. R. H. Starr is engineer of the Water and Light Department.

MONTREAL, QUE.—The Montreal Rail & Harbor Terminals, Ltd., a subsidiary of the Canadian Pacific Railway Company, plans to build a cold storage plant and terminal warehouse on Craig Street, below Place Viger Station, to cost about $5,000,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 15, 1926)

1,588,538. ELECTRICAL MEASURING INSTRUMENT; C. L. Fortescue, Pittsburgh, Pa. App. filed Aug. 30, 1920. Method of and means for determining the phase-sequence volt-amperes, power, power factor and unbalance factor of a polyphase circuit.

1,588,539. TESTING DEVICE; G. L. Fortescue, Pittsburgh, Pa. App. filed Sept. 23, 1922. Portable testing outfit for calibrating current and potential transformers, greatly facilitating the determination of the phase angle and ratio of the transformers.

1,588,544. DEVICE FOR CONVERTING PRESSURE EFFECTS INTO EQUIVALENT ELECTRICAL EFFECTS; A. Frisch, Munich-Solln, Germany. App. filed June 23, 1923. For the purpose of enabling a transmission of the former over a distance, which conversion is, for instance, utilized in arrangements for measuring the power of reciprocating engines.

1,588,556. EXPANSION CONNECTOR; A. W. Thompson, East McKeesport, Pa. App. filed March 14, 1921. Flexible expansion connectors for permitting the expansion of a conductor attached to a substantially stationary terminal.

1,588,558. SHEATHED HEATING UNIT; F. Thornton, Jr., Pittsburgh, Pa. App. filed April 29, 1924.

1,588,571. TRANSFORMER FOR MERCURY-VAPOR LAMPS; H. Busse, Hanau-on-the-Main, Germany. App. filed May 14, 1924. Allows the separate inductance coil as well as the other auxiliary devices hitherto employed to be dispensed with.

1,588,572. CIRCUIT-TESTING DEVICE; C. L. Chatham, Paterson, N. J. App. filed April 12, 1923. For locating faults in electric circuits, such as grounds, leaks, crosses, etc.

1,588,581. ELECTRIC METERING SYSTEM; H. L. Ingram, Dallas Tex., and G. T. Haltom, Port Arthur, Tex. App. filed Oct. 12, 1922. For remote metering.

1,588,586. MOTOR-CONTROL SYSTEM; M. F. Jones, Wilkinsburg, Pa. App. filed April 27, 1922. For governing one or more single-phase commutator motors during regeneration.

1,588,608. GALVANIC BATTERY; R. Oppenheim, Levallois-Perret, France. App. filed May 20, 1924. Having a large output.

1,588,611. ELECTRIC FURNACE; T. A. Reid, Wilkinsburg, Pa. App. filed June 25, 1921. Resistor-supporting means for an electric furnace.

1,588,621. RENEWABLE FUSE; P. A. Savoy, Fullerton, Cal. App. filed Oct. 29, 1924.

1,588,631. REGULATION SYSTEM; H. W. Smith and F. M. Billheimer, Wilkinsburg, Pa. App. filed June 2, 1924. For maintaining a predetermined load on a direct-current generator.

1,588,641. ELECTRIC HEAT-TREATING FURNACE; J. C. Woodson, East Pittsburgh, Pa. App. filed July 13, 1923. Tunnel-type electric annealing furnace.

1,588,710. PRESSURE - OPERATED SNAP SWITCH; M. D. Dominguez, New Orleans, La. App. filed Nov. 22, 1923. Which may be operated by fluid pressure.

1,588,711. ELECTROMAGNETICALLY OPERATED MOTOR; M. D. Dominguez, New Orleans, La. App. filed May 13, 1925. May be utilized to actuate the brakes upon a vehicle, the points of a railway switch or for other analogous service.

1,588,726. DRY CELL; W. F. Hendry, Ossining, N. Y. App. filed Nov. 8, 1923. In which flaked carbonaceous material—that is, graphite—is used in a new and improved manner, together with a suitable depolarizer, such as manganese dioxide.

1,588,749. ALTERNATING-CURRENT COMMUTATOR MACHINE; M. Kostenko and N. Japolsky, London, England. App. filed June 30, 1923. The stator windings are connected through slip rings with the segments of a commutator whose speed is lower than the speed of the rotor and whose brushes are connected through slip rings with the rotor windings.

1,588,776. FLUID HEATER; M. H. Schoenberg and L. Schon, San Francisco, Cal. App. filed April 30, 1924. For heating water or other fluids in any conventional container.

1,588,802. INSULATOR FOR BATTERY PLATES; R. B. Owen, Washington, D. C. App. filed Nov. 26, 1919.

1,588,803 ELECTRIC BATTERY; R. B. Owen, Washington, D. C. App. filed March 29, 1922. With means for selectively using any number of the cells of the battery that may be desired.

1,588,831. SIGN CONTROLLER; M. Yokoyama, Tokyo, Japan. App. filed May 19, 1924.

1,588,835. SUPERVISORY ALARM SYSTEM; T. F. Hornaday, Chicago, Ill. App. filed Feb. 19, 1920. Automatic fire-extinguishing system.

1,588,858. QUICK-MAKE AND QUICK-BREAK ELECTRIC SWITCH; R. D. Smith, Scarsdale, N. Y. App. filed Feb. 25, 1921.

1,588,893. ELECTRIC SWITCH; H. K. Krantz, Wilkinsburg, Pa. App. filed Aug. 8, 1922. For use in connection with small motors such as are employed for driving household appliances, and it has for one of its objects the provision of a compact structure embodying switches for controlling the circuits through the starting and running windings of a motor, together with means for automatically interrupting the circuit through the motor in case a short circuit or an overload occurs either during the starting of the motor or when such motor is operating under running conditions.

1,588,959. STORAGE BATTERY; E. Gregg, Claremore, Okla. App. filed Dec. 13, 1923. Terminal seal.

1,588,976. ELECTRICAL APPARATUS FOR GENERATING OZONE; J. McBlain, London, England. App. filed April 12, 1924.

1,588,981. ELECTRIC CONTROLLER; F. Morris, London, England. App. filed June 17, 1924. Master switch, by which an auxiliary electric, pneumatic or other type of motor is to be controlled, and a switch or arrangement of switches operated by the auxiliary motor are arranged so that one sets a circuit or circuits in condition to cause the auxiliary motor to move and the other when the said motor or a part driven by it reaches the desired position operates to cancel the setting brought about by the first and so brings the motor to rest.

1,589,017. METHOD AND MEANS FOR ELECTRIC ARC WELDING; J. C. Lincoln, East Cleveland, Ohio. App. filed Oct. 11, 1918.

1,589,027. ELECTRIC HAIR CLIPPER; L. J. Wahl, Sterling, Ill. App. filed Aug. 9, 1923.

1,589,031. SWITCH MECHANISM; L. J. Wick, Highland, Ill. App. filed May 31, 1924. For an organ.

1,589,054, 1,589,055. STARTING APPARATUS FOR DIRECT-CURRENT MOTORS; R. W. Cousins, Gary, Ind. Apps. filed Nov. 25, 1921, and Jan. 29, 1923. A plurality of resistance units, or sections, are cut out to give the desired amount of current for operating the motor, with the desired acceleration.

1,589,066. CONTACT DEVICE FOR ELECTRIC SWITCHES; W. J. Gibbons, Philadelphia, Pa. App. filed Feb. 2, 1922.

1,589,094. LAMINATED MICA PRODUCT; L. E. Barringer and C. F. Peterson, Schenectady, N. Y. App. filed Sept. 13, 1922. For making commutator collars, commutator segment insulators, etc.

1,589,102. CURLING-IRON HEATER; J. Brandstetter, Chicago, Ill. App. filed Dec. 15, 1924.

1,589,159. SELECTOR MECHANISM FOR TYPEWRITERS; G. A. Henriquez, New York, N. Y., and A. Diaz, Brooklyn, N. Y. App. filed Nov. 14, 1925.

1,589,161. THERMAL CUT-OUT; J. D. Hilliard, Schenectady, N. Y. App. filed Nov. 1, 1923. Of the expulsion type, in which a fusible conductor is arranged longitudinally within a discharge barrel so that upon the sudden fusion of the conductor by the passage of excess current the gases evolved will be directed lengthwise thereof and blow out any arc and any unfused portion of the conductor.

1,589,164. SOCKET FOR INCANDESCENT LAMPS; R. Hitchcock, Pittsfield, Mass. App. filed March 27, 1922. For decorative lighting.

1,589,211. ELECTRIC BATTERY FOR CLOCKS; B. Newth and O. Newth, Sydney, New South Wales, Australia. App. filed Nov. 26, 1923.

1,589,212. STORAGE-BATTERY SEPARATOR AND PROCESS OF MANUFACTURE; H. W. Nordyke, Indianapolis, Ind. App. filed Oct. 30, 1922.

1,589,214. REACTANCE; S. I. Oesterreicher, New York, N. Y. App. filed April 18, 1922. A reactor including a housing composed of concrete segments formed with recesses, a winding and insulators of substantially constant dielectric strength held in such recesses and bearing against the winding and insulating the latter from the housing.

1,589,266. ELECTRIC INDUCTION FURNACE; D. L. Summey, Waterbury, Conn. App. filed May 28, 1923. Avoids stirring of the bath by electrical effects.